DOCUMENT RESUME

ED 153 785 SE 023 755

AUTHOR	Pierce, David R.
TITLE	Industrial Special Wastes Generated in Iowa and Manpower Characteristics of Employee Handlers, Volume I.
INSTITUTION	North Iowa Area Community Coll., Mason City.
SPONS AGENCY	Iowa State Dept. of Public Instruction, Des Moines.
PUB DATE	Apr 77
CONTRACT	76-4300-01
NOTE	182p.; For Volume II, see SE 023 756; Marginal legibility in Appendices ; Best copy available
EDRS PRICE	MF-$0.83 HC-$10.03 Plus Postage.
DESCRIPTORS	*Environmental Education; Environmental Technicians; *Industry; Job Skills; Legislation; Manpower Needs; Pesticides; *Pollution; *Waste Disposal
IDENTIFIERS	Iowa

ABSTRACT

This document, Vol. I in a set, presents information obtained from a survey of industry in Iowa to determine the use and quantities, distribution, and treatment and disposal practices of hazardous waste generators. Additionally, it tabulated the number and manpower characteristics of employees who are in daily contact with such hazardous materials. The information was utilized to identify the training needs in industry and resulted in development of two training modules. (CS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED153785

EPA 000 012

SPECIAL SUBSTANCES REPORT 1977

Volume I

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Mary Jo Bruett

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

INDUSTRIAL SPECIAL WASTES GENERATED IN IOWA AND MANPOWER CHARACTERISTICS OF EMPLOYEE HANDLERS

BEST COPY AVAILABLE

Cooperating Agencies:

Iowa Department of Public Instruction
Office for Planning and Programming
Iowa Department of Agriculture
Job Service of Iowa
U. S. Environmental Protection Agency
Iowa Department of Environmental Quality

Contractor:

North Iowa Area Community College
Sub-Contractor:
Garrity-Sandage Associates, Inc.

niacc

SE 023 755

Contract #76-4300-01

Project Title:

HAZARDOUS SUBSTANCES AND PESTICIDE SURVEY AND TRAINING PROGRAM

Prepared for

Iowa Department of Public Instruction
Office of Planning and Programming
Iowa Department of Agriculture
Job Service of Iowa*
U.S. Environmental Protection Agency
Iowa Department of Environmental Quality

VOLUME I

Submitted by

Dr. David R. Pierce, Project Officer

North Iowa Area Community College
500 College Drive
Mason City, Iowa

Written and Edited by

Garrity-Sandage Associates, Inc.
Mason City, Iowa

April 1977

The preparation of this document was financially aided through a contract with the Iowa Department of Environmental Quality, the Iowa Department of Public Instruction, the Office for Planning and Programming, the Iowa Employment Security Commission, the Iowa Department of Agriculture and the United States Environmental Protection Agency.

*formerly Iowa Employment Security Commission

TABLE OF CONTENTS

PAGE

FOREWORD ix

ACKNOWLEDGMENTS x

PREFATORY NOTES xi

INTRODUCTION 1
  Background 1
  Objectives 1

SUMMARY 3

CONCLUSIONS 5

RECOMMENDATIONS 9

SURVEY DESIGN 13
  Scope 13
    Definition of Hazardous Materials 13
  Data Collection 14
    Sampling Procedures 14
    Estimation 18
    Interview Procedures 19
    Survey Instruments 21
    Limitations of the Study 22

SUMMARY OF SURVEY FINDINGS 25
  Manpower Characteristics Survey 25
    Location of Firms and Employees 26
    Size of Companies 27
    Percent of Work Force Contacting Hazardous Materials 28
    Job Categories and Job Longevity 28
    Job Functions 30
    Education and Training 33
    Employer Provided Training - Amount and Type 34
    Competencies of Employees 37
      Analysis of Employer Competency Ratings 37
      Analysis of Employee Competency Ratings 43
    Comparison of Employer/Employee Responses 48
    Needed Training 50
    Who Should be Trained? 51
    What Should be Taught? 52
    How Should Training be Delivered? 52
  Industrial Survey 53
  Volumes, Locations and Types of Special Wastes 55
  Treatment, Transportation and Disposal of Wastes 59
    Solid Waste 61
    Liquid Waste 61
    Sludge Waste 61
    Contract Carriers 62

TABLE OF CONTENTS (Cont'd)

PAGE

Major Employers vs. Minor Employers 62
Storage of Wastes 64
Labeling of Wastes 69
Summary of Findings by Major Group SIC Classifications 71
  SIC 07 - Agricultural Services 71
  SIC 24 - Lumber and Wood Products, Except Furniture 72
  SIC 26 - Paper and Allied Products 74
  SIC 27 - Printing, Publishing, and Allied Industries 75
  SIC 28 - Chemicals and Allied Products 76
  SIC 30 - Rubber and Miscellaneous Plastic Products 77
  SIC 33 - Primary Metal Industries 78
  SIC 34 - Fabricated Metal Products, Except Ordnance, Machinery and Transportation Equipment 79
  SIC 35 - Machinery, Except Electrical 81
  SIC 36 - Electrical Machinery, Equipment and Supplies 82

COLLECTION AND REVIEW OF MATERIALS 85
Review of Legislation/Regulations Applicable to Hazardous Waste . . 85
Existing Federal Legislation 86
  State Governments 88
  Iowa 88
  The Department of Environmental Quality 96
  Department of Transportation 97
  Bureau of Labor 97
  Department of Public Safety 97
    Division of Fire Protection and Investigation 97
    Division of Highway Patrol 97
  Department of Agriculture 97
  Natural Resources Council 98
  State Commerce Commission 98
  Department of Public Health 98
  The Department of Soil Conservation 99
  Department of Public Defense, Office of Disaster Services 99
  Analysis of State Agency Interviews 99
  Other States 101
  Reports by State Agencies 102
  The Battelle Report 103
  EPA Report 103

APPENDIX A: MAP OF AREA SCHOOL QUADRANT BOUNDARIES SURVEY INSTRUMENTS AND INSTRUCTIONS 107

APPENDIX B: MANPOWER TABLES 119

APPENDIX C: INDUSTRIAL WASTE TABLES 129

APPENDIX D: A SUMMARY OF IOWA DEPARTMENTAL RULES PERTAINING TO HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT 145

REFERENCES 151

LIST OF TABLES

TABLE | PAGE

1 DISTRIBUTION OF FIRMS IN THE UNIVERSE CLASSIFIED BY SELECTION METHOD AND EPA CLASSIFICATION 15

2 DISTRIBUTION OF FIRMS IN THE SAMPLE CLASSIFIED BY SELECTION METHOD AND GEOGRAPHIC AREA 16

3 DISTRIBUTION OF FIRMS IN THE CORRECTED UNIVERSE, SELECTED IN THE SAMPLE AND RESPONDING, CLASSIFIED BY NUMBER OF EMPLOYEES AND GEOGRAPHIC AREA 17

4 ESTIMATED TOTAL NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION 29

5 MANPOWER AND TRAINING CHARACTERISTICS OF EMPLOYEES WHO INDICATE DAILY CONTACT WITH HAZARDOUS MATERIALS 36

6 TOTALS FOR EACH QUESTION
% STATEWIDE 39

7 EMPLOYER EVALUATION OF COMPETENCIES BY COURSE GROUPINGS
TOTALS FOR ALL QUADRANTS, SIC'S & SIZE 40

8 EMPLOYER EVALUATION OF COMPETENCIES WITHIN STANDARD INDUSTRIAL CLASSIFICATION OF FIRMS BY COURSE GROUPINGS 41

9 EMPLOYER EVALUATION OF COMPETENCIES GROUPED ACCORDING TO SUBJECT AREAS BY SIZE OF FIRM
STATEWIDE
By Size <100
By Size >100 42

10 EMPLOYEE EVALUATION OF COMPETENCIES BY COURSE GROUPINGS
TOTALS FOR ALL QUADRANTS, SIC'S & SIZE 43

11 JOB CATEGORIES 45

12 TIME AT PRESENT JOB (YEARS) 45

13 AGE CLASSES 46

14 SIC 46

15 SIZE OF INDUSTRY 47

16 OVERALL EMPLOYEE INDICATED NEED FOR IMPROVEMENT BY JOB CATEGORY 47

LIST OF TABLES (Cont'd)

TABLE		PAGE
17	EMPLOYER/EMPLOYEE RESPONSES ALL SUBJECT AREAS	48
18	EMPLOYERS	49
19	EMPLOYEES	49
20	ESTIMATED NUMBER AND % OF FIRMS USING SPECIAL SUBSTANCES AND GENERATING SPECIAL WASTES BY SIZE	51
21	VOLUME OF WASTE IN EACH AREA SCHOOL QUADRANT BY TYPE	56
22	ESTIMATED TOTAL NUMBER OF FIRMS GENERATING HAZARDOUS WASTE CLASSIFIED BY MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION	58
23	ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED BY IOWA FIRMS CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT AND DISPOSAL	60
24	ESTIMATED VOLUME OF HAZARDOUS WASTES GENERATED BY IOWA FIRMS CLASSIFIED BY SIZE OF COMPANY AND PERCENT OF TOTALS	63
25	ESTIMATED NUMBER OF FIRMS GENERATING NONSOLID WASTE CLASSIFIED BY PLACE OF STORAGE OF WASTE AT PLANT SITE, AMOUNT OF WASTE STORED OVER 24 HOURS, AND TYPE OF WASTE	66
26	ESTIMATED NUMBER OF FIRMS GENERATING SOLID WASTE CLASSIFIED BY PLACE OF STORAGE OF WASTE AT PLANT SITE, AMOUNT OF WASTE STORED OVER 24 HOURS, AND TYPE OF WASTE	67
27	ESTIMATED NUMBER OF FIRMS BY QUADRANT WHO STORE HAZARDOUS WASTE	68
28	ESTIMATED NUMBER OF FIRMS STORING WASTE USING DIFFERENT TYPES OF LABELING CLASSIFIED BY TYPE OF WASTE	70
29	IOWA DEPARTMENTAL RULES, 1973 AND CODE OF IOWA, 1975	89
30	REGULATIONS OF IOWA STATE DEPARTMENTS PERTAINING TO HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT According to Iowa Departmental Rules, 1973	90
31	PHASES OF THE LIFE CYCLE OF HAZARDOUS MATERIALS	94

LIST OF TABLES (Cont'd)

TABLE PAGE

APPENDIX B:

1 ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE AND QUADRANT 119

2 ESTIMATED NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE AND QUADRANT 120

3 ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE HANDLED AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION 121

4 ESTIMATED AVERAGE NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES PER FIRM CLASSIFIED BY TYPE OF SUBSTANCE HANDLED AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION 122

5 ESTIMATED MANPOWER CHARACTERISTICS OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY POSITION 123

6 ESTIMATED MANPOWER CHARACTERISTICS OF FIRMS CLASSIFIED BY POSITION AND TYPE OF SUBSTANCE HANDLED 124

7 ESTIMATED MANPOWER CHARACTERISTICS OF FIRMS CLASSIFIED BY JOB FUNCTION AND POSITION 125

8 ESTIMATED NUMBER OF EMPLOYEES CLASSIFIED BY EDUCATIONAL BACKGROUND AND QUADRANT 126

9 ESTIMATED AVERAGE LENGTH OF TRAINING PROGRAMS (IN HOURS) CLASSIFIED BY TYPE OF PROGRAM AND QUADRANT 127

10 ESTIMATED NUMBER OF FIRMS HAVING TRAINING PROGRAMS CLASSIFIED BY TYPE OF PROGRAM AND QUADRANT 128

APPENDIX C:

1 ESTIMATED AMOUNT OF SOLID HAZARDOUS WASTE GENERATED CLASSIFIED BY TYPE OF WASTE AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION 129

2 ESTIMATED AMOUNT OF NONSOLID HAZARDOUS WASTE GENERATED CLASSIFIED BY TYPE OF WASTE AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION 130

LIST OF TABLES (Cont'd)

TABLE PAGE

APPENDIX C: (Cont'd)

3 ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS MATERIAL BUT GENERATING NO HAZARDOUS WASTE CLASSIFIED BY QUADRANT 131

4 ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED BY IOWA FIRMS WITH MORE THAN 100 EMPLOYEES CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 132

5 ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED BY IOWA FIRMS WITH 100 OR LESS EMPLOYEES CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 133

6 ESTIMATED VOLUMES OF FLAMMABLE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 134

7 ESTIMATED VOLUMES OF PATHOLOGICAL WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 134

8 ESTIMATED VOLUMES OF TOXIC WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 135

9 ESTIMATED VOLUMES OF CORROSIVE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 135

10 ESTIMATED VOLUMES OF REACTIVE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 136

11 ESTIMATED VOLUMES OF UNCLASSIFIED WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL 136

12 ESTIMATED NUMBER OF FIRMS GENERATING FLAMMABLE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 137

13 ESTIMATED NUMBER OF FIRMS GENERATING PATHOLOGICAL WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 137

LIST OF TABLES (Cont'd)

TABLE PAGE

APPENDIX C: (Cont'd)

14 ESTIMATED NUMBER OF FIRMS GENERATING TOXIC WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 137

15 ESTIMATED NUMBER OF FIRMS GENERATING CORROSIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 138

16 ESTIMATED NUMBER OF FIRMS GENERATING REACTIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 138

17 ESTIMATED NUMBER OF FIRMS GENERATING UNCLASSIFIED WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS 138

18 ESTIMATED NUMBER OF FIRMS GENERATING FLAMMABLE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 139

19 ESTIMATED NUMBER OF FIRMS GENERATING PATHOLOGICAL WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 139

20 ESTIMATED NUMBER OF FIRMS GENERATING TOXIC WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 139

21 ESTIMATED NUMBER OF FIRMS GENERATING CORROSIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 140

22 ESTIMATED NUMBER OF FIRMS GENERATING REACTIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 140

23 ESTIMATED NUMBER OF FIRMS GENERATING UNCLASSIFIED WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY 140

24 ESTIMATED NUMBER OF FIRMS STORING FLAMMABLE WASTE USING DIFFERENT TYPES OF LABELING 141

LIST OF TABLES (Cont'd)

TABLE PAGE

APPENDIX C: (Cont'd)

25 ESTIMATED NUMBER OF FIRMS STORING TOXIC WASTE USING DIFFERENT TYPES OF LABELING 141

26 ESTIMATED NUMBER OF FIRMS STORING PATHOLOGICAL WASTE USING DIFFERENT TYPES OF LABELING 141

27 ESTIMATED NUMBER OF FIRMS STORING CORROSIVE WASTE USING DIFFERENT TYPES OF LABELING 142

28 ESTIMATED NUMBER OF FIRMS STORING REACTIVE WASTE USING DIFFERENT TYPES OF LABELING 142

29 ESTIMATED NUMBER OF FIRMS STORING UNCLASSIFIED WASTE USING DIFFERENT TYPES OF LABELING 142

30 MISCELLANEOUS ESTIMATES 143

FOREWORD

The cumulative effect of various unavoidable delays resulted in a four-month overrun on the final report. These delays meant that neither the Iowa Executive nor Legislative branches of Government could formulate legislative recommendations prior to their 1977 recess.

Therefore all tables and some tentative conclusions were supplied the Department of Environmental Quality during January and February, 1977, for use in recommending legislation during the first session of the 67th General Assembly.

Limited copies of this publication are available without charge from the Assistant Dean of Instruction, North Iowa Area Community College, Mason City, Iowa 50401.

ACKNOWLEDGMENTS

William McKeown served as Assistant Project Officer for the contract and coordinated the resources of the college with Garrity-Sandage Associates, Inc., the subcontractor, who assumed responsibility for designing and conducting the study, writing Volume I, and editing the entire report. The Project Officer is grateful to Shirley Sandage and Margaret Garrity who have demonstrated diligence, patience, and a high level of competence in carrying out the terms of this contract.

John Rothamel was helpful with advice and counsel throughout the entire project.

Staff from the Department of Environmental Quality including Charles Miller, B. Z. Karachiwala, Dr. Michael Hanson, Ron Kolpa, and Tim Kaiser and from the Department of Public Instruction including Dr. William Baley and Don Wederquist all supplied technical assistance and helpful comments.

Staff from the Region VII Office of the United States Environmental Protection Agency including Jack Coakley and Dr. Max Wilcomb supplied support and encouragement and met with us on several occasions.

Dr. Roy Hickman and his staff at the Iowa State University Statistical Laboratory supplied technical assistance and statistical support in drawing the sample and in extrapolating the data.

Iowa's industries were most courteous and cooperative in the data collecting phase and in making available technical personnel to assist with the development of the two course modules which were recommended by Garrity-Sandage Associates, Inc.

Iowa agency officials who assisted with the review of regulatory and administrative responsibilities also made an important contribution.

David R. Pierce

Dr. David R. Pierce, Project Officer

PREFATORY NOTES

Garrity-Sandage Associates, Inc. wishes to acknowledge and thank the North Iowa Area Community College for their encouragement and cooperation as prime contractor for the project from which this study stems.

GSAI also acknowledges and thanks the cooperation and courteous consideration extended by each of the cooperating funding agencies. Project officers and other staff personnel with each of the six agencies made specific and substantial contributions to the development of the study.

Technical assistance and cooperation from Iowa State University, Iowa agency officials and cooperating industries and their employees were especially important and are gratefully acknowledged.

The development and publishing of this study has been made pleasurable by the cooperation of the many persons and organizations that were contacted during the study period.

Staff who have so ably assisted in the development and writing of this volume include Bridget McCarron, Michael Gasperi, Milton Owen, H. Dean Davies and Linda Janssen.

The material contained herein is being made available in the hopes it will add new insights into urgent problems that challenge people and institutions who must deal with the environment and its relationship to mankind.

Garrity-Sandage Associates, Inc.
Subcontractor

Shirley Sandage
Shirley Sandage, President

INTRODUCTION

Background

Each year the United States produces an estimated 10 million tons of industrial waste considered to be hazardous. Such wastes are defined as wastes "which pose a substantial present or potential hazard to human health or living organisms because they are lethal, non-degradable, persistent in nature, can be biologically magnified, or otherwise cause or tend to cause detrimental cumulative effects".[1]

Although such materials have been broadly recognized and classified, very little is known about specific production levels and/or handling and disposal techniques at either the Federal or State levels. We are not fully cognizant of: 1) the types of industries involved; 2) the types of employees used by such industries in the actual handling of dangerous materials; 3) the type of training needed by such employees for competent work performance; or 4) the identification of hazardous materials dumping grounds as required by Federal law. As a result of these deficiencies, air, water and land resources have been and are being unknowingly polluted.

Several Iowa State agencies have recognized these deficiencies and in cooperation with the Regional Office of the Environmental Protection Agency (EPA) are continuously working toward solutions. These agencies as well as individuals and industry realize that protecting the public health and safety from exposure to hazardous substances and from waste products which may contain residues of hazardous substances requires a good deal of knowledge about the life cycle of such substances being used and disposed of within the State.

In order to obtain information about these substances and the persons who daily contact them as a part of their employment, six state agencies working cooperatively with the EPA contracted with the North Iowa Area Community College (NIACC) in Mason City, Iowa, to conduct a statewide study of the hazardous waste stream in Iowa. The study was conducted during the summer of 1976.

Objectives

The project as undertaken by NIACC had six major objectives as follows:

1. Estimate the number and types of industries in Iowa engaged in substantial use, handling and disposal of hazardous substances.

---

[1] Office of Solid Waste Management Programs. Disposal of hazardous wastes; report to Congress. Environmental Protection Publication SW-115 Washington, U.S. Government Printing Office, 1974. 110 p.

2. Estimate the characteristics and volume of hazardous waste generated in the State by geographic area and make an estimation about the treatment and disposal practices of generators.

3. Classify by job category and estimate the number of workers engaged in the handling of hazardous materials.

4. Determine the authority various State agencies exercise over hazardous substances within the State.

5. Determine the need for short-term training programs for industry in the handling of hazardous materials.

6. Determine the need for statewide two-year career and continuing education programs in using and handling hazardous materials.

The on-site interviews with industries throughout the State, however, provided a great deal of additional information relating to the specific form training programs should take, the level within industry to which such programs should be directed, and the current management practices of Iowa industries who generate and/or dispose of special wastes.

A major benefit of the project, while not a specific objective, was the generally high degree of cooperation which interviewers attributed to the desire by many producers of hazardous wastes to find suitable disposal facilities and/or economically feasible recycling facilities and to have input in the information gathering process prior to decisions affecting State management of difficult wastes. It was noted by many industries that lack of disposal facilities for some materials resulted either in significant storage problems, or in substantial increase in disposal costs to the producers, many of whom found they had to ship some wastes to approved sites out of the State of Iowa. NIACC was able to take advantage of this cooperative spirit to establish an Advisory Group of representatives of major companies who assisted with the design of the pilot training program called for by the contract. The survey provided a means by which producers of hazardous wastes could participate in the planning process for eventual State management of such wastes.

SUMMARY

The risk associated with the handling, transporting, storage and disposal of hazardous materials is becoming more apparent both nationally and in Iowa. These materials include toxic chemicals, pesticides, explosives, flammables, corrosives, reactive and pathological substances. Government, agriculture and industry are all becoming increasingly conscious of the inherent danger to both humans and to the environment caused by the improper handling of these materials.

Federal and state regulatory agencies are seeking ways of limiting the problems associated with the misuse of these materials. Agriculture and industry are also seeking better methods of handling these materials, disposing of residues and for training of their personnel.

The purposes of this project were twofold; first, to survey the use and quantities, the geographic distribution and the current treatment and disposal practices of hazardous waste generators in both major and minor industries in Iowa. The second purpose was to estimate the number and manpower characteristics of persons who daily contact such materials as a part of their employment. The information gained from the survey is to assist the State of Iowa in the development of a hazardous materials management program.

The project was performed over a 15 month period during which on-site surveys were taken of 244 industries, with an additional 239 interviews being conducted by telephone and/or by mail. The survey focused on manufacturers in 17 Standard Industrial Classifications (SIC) which, according to information from the Environmental Protection Agency and a review of technical literature, could generate either hazardous or potentially hazardous wastes.

An additional purpose of the project was to identify the training needs in industry of persons who daily contact hazardous materials. Based on findings, the project developed and pilot tested two training modules in the general areas of Recognition and Use, and Health and Safety.

CONCLUSIONS

Based on this survey, Iowa generates and must dispose of an estimated 573,907,000 kilograms of solid special wastes and an estimated 132,156,000 liters of nonsolid hazardous waste annually. There is no single major source of hazardous waste generation but rather multiple streams of generation across Iowa. An estimated 59% of firms generating wastes are located in the eastern half of the State (Quadrants I and IV) and 41% are located in the western half. (See Appendix A for map of quadrant boundaries)

An estimated 24,031 workers in Iowa daily handle special or hazardous materials. Of this number 15% or 3,633 individuals are at the supervisory or above level and 85% or an estimated 20,398 are less than professional or supervisory level workers. Better than 80% of the employees who daily contact these substances have a high school education or less. They also receive the least amount of employer provided training. Training they receive is generally on-the-job and by example. Both employers and employees recognize a need for additional training particularly in matters related to recognition and use of hazardous substances and in areas related to health.

Of the 2,021 Iowa firms estimated to use special or hazardous substances in their operations, 90% have fewer than 100 employees and 85% are estimated to have fewer than 50 employees. Of the 1,684 firms estimated to generate special wastes, 89% have fewer than 100 employees and 83% have fewer than 50 employees.

Large firms collectively generate substantially greater total volumes of special wastes than do small firms; however, in terms of actual volume amounts, firms with fewer than 100 employees produce a greater volume of untreated sludge waste for disposal than large firms. Major employers have greater technological capability for treatment of wastes than do smaller firms. For these reasons a State plan for management of hazardous materials should not ignore the multiple waste streams generated by small firms. Even though they are estimated to generate only 1% of the solid hazardous waste, they generate an estimated 18% of the nonsolid hazardous waste.

Industries are most apt to identify their waste characteristics as flammable, toxic or corrosive or a combination of these types. There is no significant difference in these characteristics between small employers and large employers.

Firms are most apt to provide disposal at a company site for solid waste and to contract for disposal of liquid and sludge wastes to outside carriers. This practice leads to intermingled waste streams and increases environmental risks. Most wastes remain untreated before disposal either to the land or by sewering. A substantial volume of waste is shipped out-of-state. The economics of waste disposal is probably the determining factor in treatment, or non-treatment and the disposal methods and locations sites selected. In terms of sheer volume the processing and disposal of hazardous solid waste may become Iowa's largest management problem. The disposal of agricultural chemical residues requires an alternate disposal system to those currently in practice where little control can be maintained.

CONCLUSIONS

An estimated 1,310 firms or 78% of those who generate special wastes maintain storage for longer than 24 hours. However, industry does not store its waste for more than 24 hours when immediate and satisfactory disposal methods are available. The practice of using contract carriers on a regular pick-up basis contributes to the volume of wastes being stored as well as the hazardous nature of the substances themselves and the lack of adequate disposal methods and sites. Solid wastes are most often stored outdoors, while nonsolids (especially toxics) are generally stored indoors. Iowa does not have adequate methods nor locations for disposing of hazardous substances.

On October 11, 1976, the U.S. Congress enacted Public Law 94-469 known as the "Toxic Substances Control Act" (TSCA). This Act authorizes the Federal Environmental Protection Agency (EPA) to obtain data on the production, use, health effects and other matters concerning chemical substances and mixtures. Under this Act, EPA may regulate the manufacture, processing, distribution in commerce, use and disposal of a chemical substance or mixture (Sec. 6(a)(b)). Pesticides, tobacco, nuclear material, firearms and ammunition, food, food additives, drugs and cosmetics are regulated under other laws and are exempted from this Act. Section 9(b) of the Toxic Substances Act grants the Federal administrator of EPA broad discretionary powers to coordinate activities with other Federal laws or to initiate and take actions he determines to be in the public interest under the Federal powers contained in TSCA. While nothing in the Act shall affect the authority of any State or political subdivision of a State to establish or continue regulation of hazardous materials, if EPA restricts the manufacture or otherwise regulates a chemical under the Act, a State may only issue requirements which are identical, mandated by other Federal laws, or prohibit the use of the chemical (Sec. 18(a)).

In addition to the enactment of the Toxic Substances Act, the 94th Congress also passed the Federal Resources, Conservation and Recovery Act. This Act will require the development of a management plan for the State establishing a permit system for treatment, storage and disposal of all hazardous wastes. It also contains provisions requiring training for handlers and transporters. The disposal authority contained in each of these two Federal laws will have to be coordinated and policy determined at the Federal level. These decisions will need to be carefully considered by the State in the development of a management plan. It is doubtful the large number of small firms contributing to the hazardous waste stream in Iowa will have the technological capability of complying with the requirements of these two pieces of legislation without assistance from the State.

Iowa must decide on minimum data requirements for implementing a management plan and coordinate these requirements with the differing programs and statutory requirements of various State agencies with overlapping responsibilities before making a determination as to what regulatory requirements are warranted. Guidelines developed for use by industry - large or small - will face legal and policy complexities in trying to close the "information gap" that presently exists. This paucity of information contributes to communication problems, overlap, duplication of efforts, and in many situations, inefficient utilization of human and fiscal resources. It inhibits planning, development, operation and overall effectiveness of current hazardous waste management efforts.

CONCLUSIONS

Iowa needs to take immediate steps to plan for proper disposal methods and sites for its hazardous wastes and to develop and initiate training programs for personnel who daily work with substances of a hazardous nature. It must devise better systems for dealing with emergency situations caused by spills and other accidents. The plan must be coordinated between agencies and within divisions of State agencies so that requests for information and technical assistance provided to industry will be minimally disruptive and mutually beneficial.

RECOMMENDATIONS

The State of Iowa should take steps to develop a comprehensive approach to the management of its hazardous wastes recognizing the multi-jurisdictional issues involving government as well as the private sector. A State management plan coordinated through one central agency will enable the State to more effectively initiate and synchronize responsible services in the event of either natural or accidental emergencies involving hazardous substances. It can also reduce the number and effect of emergencies through cooperative preventive advance planning with industry and government.

In formulating a State plan for hazardous waste management and disposal, the following recommendations are presented for consideration together with a brief explanation of their purpose.

- That a regulatory system to insure safe handling, transporting, storage and disposal of special wastes be adopted and based on a State/local partnership.

  Federal legislation mandates that states adopt hazardous materials management plans to safeguard human health and the environment. A high degree of cooperation from counties and municipalities, from industry, and from private citizen groups will need to be achieved if misunderstandings and undue hardships are to be avoided.

- That a management plan take a preventive approach and provisions be made for providing on-site practical technical assistance to industries (particularly small firms) to aid in compliance with applicable regulations.

  A high degree of concern for the health of citizens and the safety of the environment exists. However, both large and small firms continually stressed their concern for the duplication in requests for information from among and within various State agencies and the firms' ability to comply with requests for data with varying breakouts. In addition concern was evidenced about requesting and receiving technical assistance relating to compliance from agencies who also have regulatory and enforcement powers.

- That a classification and labeling system be developed and used in uniform planning and reporting for transportation and disposal of special wastes.

  A uniform and simplified classification system for typing and labeling of hazardous wastes is necessary. It must be easily understandable by all levels of personnel involved in the production, transporting and disposal process and contain sufficient information so that technically untrained personnel can take proper steps to insure that environmental and health hazards can be minimized and emergencies contained. Its use should be required in planning and reporting of information for all State agencies and departments within State agencies.

RECOMMENDATIONS

- That authority and management responsibilities for inspection of both public and private treatment and disposal sites for hazardous wastes should be centralized in one agency.

  Iowa activity in management of these wastes has been minimal. Effective controls and/or alternatives are necessary to insure essential technical treatment takes place at both public and private disposal sites and the safety of the environment is maintained.

- That treatment facilities and disposal sites for special wastes be established on a regional basis rather than on a county basis and that the State seek cooperative agreements with other states for disposal of particularly troublesome wastes.

  Regional planning is necessary to avoid duplication of effort, provide some economic benefit, and maintain better control and inventory over disposal of hazardous wastes. Iowa cannot expect other states to continue to accept hazardous wastes for disposal unless this is part of an overall, coordinated, and mutually agreed to planning strategy.

- That the Iowa Department of Environmental Quality be granted under emergency conditions statutory authority to direct the cleanup of spills, containment and/or disposal of hazardous materials and contaminated substances resulting from spills, and conduct cleanup where responsible party refuses or fails to do so and there is threat of an imminent hazard to human health or the safety of the environment.

  The Code of Iowa presently does not empower the state to take immediate action to direct or to clean up and/or contain spills of hazardous materials to the land. Spills on public highways are required to be reported to the nearest peace officer. Authority to take action is needed.

- That Iowa, in cooperation with industry, should plan and carry out a public education program to educate its citizens about dangers resulting from misuse or mishandling of hazardous materials.

  There is evidence of a good deal of lack of understanding about hazardous materials commonly in use. A public education program should contain clear information about common chemicals for the average citizens who cannot be expected to understand technical ingredients listed on labels but who may, through misunderstanding or lack of knowledge, contribute to the problem of hazardous waste mismanagement.

RECOMMENDATIONS

- That a State management plan contain provisions for the development and delivery of training for workers who daily contact special or hazardous substances at supervisory and less than supervisory levels.

  Both employers and their employees contacted during this study gave clear indication of a need for additional training. In order to maximize acceptability and usefulness, these programs should be developed around hazardous substances common to many industries.

- That for long-range future planning the State, in cooperation with industry, initiate and support with funding, research and demonstration projects to develop less expensive methods for recycling and reuse of chemical wastes than are presently available.

In order to adequately plan for a hazardous or special waste management system, Iowa must examine other sources of generation within the State. The reader of this study should bear in mind its limitations and constraints. Only manufacturers were included in the study. Service industries who use and dispose of hazardous materials as well as small contract carriers and interstate transporters should also be studied and their wastes inventoried before a complete picture of the hazardous waste stream in Iowa can be achieved.

SURVEY DESIGN

Scope

Human contact with hazardous industrial wastes occurs at every step of the industrial process. This study looked only at generators, i.e. manufacturers. It did not look at commercial transporters, disposers, or the service industry. However, unlike other studies, it not only looked at the waste products of industry but also, based upon the willingness of management and its employees to provide information, attempted to look at the manpower characteristics of persons who work with hazardous or special substances, and determine something about the type and volume of waste generated by that production. For convenience the material and waste types were classified as flammable, explosive, pathological, toxic, corrosive, reactive, or otherwise unclassified. Each of these types requires special handling in order to protect the worker and/or his environment. Each of these types of materials has the potential to generate hazardous waste.

There is presently no uniform criteria for identifying the characteristics of hazardous waste. Nor have the problems associated with improper treatment and disposal of such products been widely recognized and understood. Certainly appropriate identifying criteria should take into account toxicity, persistence and degradability in nature, potential for accumulation in living tissue, and other related factors. It was not within the scope of this study to collect waste samples and to perform laboratory analysis as a method for identifying the potential for hazardous waste; rather the study worked with business and industry and depended on the voluntary contribution of information from industries who generate industrial wastes. The study looked at very small firms with from 0 to 25 employees as well as those industries with thousands of employees. For purposes of this report, estimates will be reported for firms with 100 or fewer employees, and for firms with more than 100 employees.

Definition of Hazardous Materials. The Resource Conservation and Recovery Act of 1976, Title III--Hazardous Waste Management, Section 301, requires the Federal Government within 18 months of passage to develop and promulgate criteria for identifying the characteristics of hazardous waste and for listing hazardous waste which should be subject to the provisions of the Act.

For purposes of this study, the following definitions were used:

FLAMMABLE	Any liquid with a flash point below 200°F (93.3°C) or any solid material, other than explosives, which is liable to cause fires through friction, absorption of moisture, spontaneous chemical changes, retained heat from manufacturing or processing; or which can be ignited readily, and when ignited burns so vigorously and persistently that it creates a serious hazard.
EXPLOSIVE*	Any chemical material or device, the primary or common purpose of which is to function by explosion, i.e., by a substantially instantaneous release of gas or heat, or any material contaminated with an explosive.

*(Wastes in this category were later merged with reactive wastes due to the limited use of such materials in the firms included in the sample.)

CORROSIVE	Any liquid or solid that causes destruction of human skin tissue, or a liquid that has a severe corrosion rate on steel or aluminum. Generally a material with a pH greater than 9.5 or less than 4.5.
PATHOLOGICAL	Any materials that may contain viable microorganisms or toxins which may cause human disease.
TOXIC	Any materials which are poisonous to humans or wildlife when ingested, absorbed through the skin or inhaled. This will also include materials which are irritants, carcinogenic or bioaccumulative.
REACTIVE	Any material which reacts vigorously with water; is an oxidizing agent and can supply sufficient oxygen to sustain a chemical reaction in the absence of air; or is chemically unstable and may undergo polymerization, is temperature sensitive, light sensitive, shock sensitive, or will undergo chemical decomposition or reaction presenting a hazard.
UNCLASSIFIED	Any material not previously classified, but which requires special procedures for storage, transporting, handling or disposal to insure the safety of the worker or the environment.

Firms participating in the survey were asked to inventory their wastes by type. Both generic and trade names for products destined for disposal were accepted as well as chemical names and compounds: No attempt was made to compile a list of materials identified by the survey, since the study concerned itself only with types of substances.

Data Collection

Sampling Procedures. Study procedures specified the selection of a sample of Iowa manufacturing firms for which data would be collected on 1) use and disposal of hazardous substances, and 2) manpower characteristics of employees who handle such substances. A computer file of Iowa employers, obtained from the Iowa Employment Security Commission (IESC), was used as the basic sampling frame. In order to be included in this IESC file, a firm must have met at least one of the following requirements: (1) had at least one employee during at least 20 weeks of the current year, or (2) had a quarterly payroll of $1,500 or more during one or more quarters of the current or prior year. A list of Standard Industrial Classification (SIC) numbers was specified by the Iowa Department of Environmental Quality (DEQ), and any firm with a SIC code not corresponding to those on this list was deleted from the file at Iowa State University Statistical Laboratory. The file was checked and duplicate listings of firms were deleted. Using the Directory of Iowa Manufacturers, firms which might generate potentially hazardous waste were added to the list by the subcontractor. Firms with SIC numbers designated by the Environmental Protection Agency (EPA) as having hazardous waste which were not on the original IESC tape file were also added. The resulting list, totaling 2,847 firms, was considered the universe of manufacturers of interest. Hence, it constituted the sampling frame.

The objectives of the study called for estimates to be made by 1) SIC classifications of manufacturers for the entire State, and 2) four geographic areas of the State for all firms. (See Appendix A for map) The list frame was divided into two primary strata; firms with EPA primary SIC numbers, and all other firms. Within each strata, firms were classified according to size (number of employees) and geographic area. The size by area and by SIC cell constituted the stratification used in sample selection. Firms that employed more than 100 persons, or that were classified in a cell containing very few firms, were selected with certainty. The distribution of certainty and noncertainty firms by EPA classification is shown in Table 1.

TABLE 1

DISTRIBUTION OF FIRMS IN THE UNIVERSE CLASSIFIED BY SELECTION METHOD AND EPA CLASSIFICATION

EPA Classification	Number of Firms: Selected with Certainty	Remainder	Total
Primary	107	231	338
Nonprimary	178	2,331	2,509
Total	285	2,562	2,847

The firms not selected with certainty were sampled within area by size by two-digit SIC cells. Sampling rates for each cell were set so that, in general, larger firms were sampled at a higher rate. A total of 594 firms was included in the sample. The distribution of all sample firms, classified by type of selection and geographic area, is shown in Table 2. A sample of this type is called a random stratified sample.

TABLE 2

DISTRIBUTION OF FIRMS IN THE SAMPLE CLASSIFIED BY SELECTION METHOD AND GEOGRAPHIC AREA

Geographic Area	Sample Firms			Certainty Firms	All Firms
	EPA Primary	EPA Nonprimary	Subtotal		
1	10	62	72	69	141
2	10	57	67	37	104
3	11	70	81	66	147
4	21	68	89	113	202
Total	52	257	309	285	594

The geographic area designation was that established by the Iowa Department of Public Instruction for planning purposes of the Community College system. Such a designation was considered necessary since any training programs evolving from the study would be offered through the community college system. The geographic boundaries roughly divide the State into four quadrants of nearly equal size. The north-south boundary runs from east to west just north of Des Moines, and the east-west boundary runs from north to south just east of Des Moines. Principal cities in Quadrant I are Waterloo, Dubuque and Mason City; in Quadrant II, Fort Dodge and Sioux City; in Quadrant III, Des Moines and Council Bluffs; and in Quadrant IV, Cedar Rapids, Clinton, Davenport, Keokuk, Fort Madison and Burlington. (See Appendix A for map)

Responses were obtained from 483 sample firms. Identified during the enumeration phase were 49 firms who were either out of business or had been listed more than once on the universe frame. The universe and the sample listings were corrected for these changes. The total number of firms in the corrected universe, the number selected in the sample, and the number enumerated are shown in Table 3.

TABLE 3

DISTRIBUTION OF FIRMS IN THE CORRECTED UNIVERSE, SELECTED IN THE SAMPLE AND RESPONDING, CLASSIFIED BY NUMBER OF EMPLOYEES AND GEOGRAPHIC AREA

Geographic area		Number of employees							
		20 or less	21-50	51-100	101-250	251-500	501-1000	More than 1000	Total
I	Universe	514	82	31	31	8	4	5	675
	Sample	47	20	15	31	8	4	5	130
	Responding	44	18	13	29	7	4	3	118
II	Universe	469	64	23	18	5	-	-	579
	Sample	42	17	14	18	5	-	-	96
	Responding	40	16	14	13	5	-	-	88
III	Universe	571	95	35	25	10	3	8	747
	Sample	48	20	19	25	10	3	8	133
	Responding	44	17	18	22	9	3	4	117
IV	Universe	541	105	58	50	24	9	10	797
	Sample	43	22	28	50	24	9	10	186
	Responding	41	18	26	43	19	7	6	160
All firms	Universe	2,095	346	147	124	47	16	23	2,798
	Sample	180	79	76	124	47	16	23	545
	Responding	169	69	71	107	40	14	13	483

Estimation. Estimation of characteristics of the 2,798 firms in the hazardous waste universe was based upon data collected from the 483 sample firms. Population weighting factors (weights) were constructed for each sample firm in the following manner. Let

N_{ijk} = the number of firms in the universe within the i^{th} geographic area, j^{th} SIC group, and k^{th} size class (number of employees).

n_{ijk} = the number of firms enumerated within the i^{th} geographic area, j^{th} SIC group, and k^{th} size class.

The weight for a sample firm was calculated as

$$W_{ijk\ell} = \frac{N_{ijk}}{n_{ijk}} ,$$

where the subscript ℓ denotes the ℓ^{th} firm within a particular area by SIC by size cell. Thus, the weight of a particular firm is the number of firms in the universe in a cell divided by the number of sample firms in that cell.

In thirteen cases, there was only one firm in a cell and, for some reason, that firm was not enumerated. In these cases, a responding firm within the same area and SIC classification having as nearly as possible the same size classification was randomly chosen to represent the nonresponding firm. Responses to all questions of the responding firm were ratio adjusted for any size differences and the data substituted for the nonresponding firms.

To define the estimation procedures, consider the following notation. Let

$Y_{ijk\ell}$ = the observed characteristic of interest for the ℓ^{th} sample firm within the k^{th} size class (number of employees), j^{th} SIC group and i^{th} geographic area

where

$i = 1,2,3,4$

$j = 1,2,\ldots,r$ (r = # of SIC groups)

$k = 1,2,\ldots,7$

$\ell = 1,2,\ldots,n_{ijk}$.

SURVEY DESIGN

For quantitative variables, $Y_{ijk\ell}$ is simply the value of the variable for a particular firm. For qualitative or classification variables, such as whether or not a firm produces hazardous waste, the value of $Y_{ijk\ell}$ is 1 if the firm produces waste and 0 if it does not. An estimated total of the Y-characteristic for the hazardous waste universe of firms is

$$\hat{Y} = \sum_{i=1}^{4} \sum_{j=1}^{r} \sum_{k=1}^{7} \sum_{\ell=1}^{n_{ijk}} W_{ijk\ell} Y_{ijk\ell} \quad .$$

For an estimated mean per firm of a particular characteristic,

$$\hat{\bar{Y}} = \frac{\sum_{i=1}^{4} \sum_{j=1}^{r} \sum_{k=1}^{7} \sum_{\ell=1}^{n_{ijk}} W_{ijk\ell} Y_{ijk\ell}}{\sum_{i=1}^{4} \sum_{j=1}^{r} \sum_{k=1}^{7} \sum_{\ell=1}^{n_{ijk}} W_{ijk\ell}} \quad .$$

Variance estimates were computed using the formulas for stratified sampling.[2] Some estimates are of the ratio form and the variances were estimated using the Taylor approximations.[3] Approximate 95% confidence intervals were constructed by adding and subtracting twice the estimated standard error of the estimate to the estimate. In approximately 95% of the cases, the interval so constructed will cover the true value.

Interview Procedures. The North Iowa Area Community College (NIACC) with the approval of the Department of Environmental Quality subcontracted for the design, conduct and preparation of the results for the hazardous materials and manpower study with Garrity/Sandage Associates, Inc. (GSAI), Mason City, Iowa. This volume essentially is a report of work performed by the subcontractor.

The original contract called for statistical and data processing support to be provided by the Department of Public Instruction (DPI). DPI provided this support through a separate contract which they negotiated with the Statistical Laboratory at Iowa State University (ISU) in Ames. Although the contracts between NIACC and GSAI and between DPI and ISU did not contain the same time frames, there was generally a close working relationship between the parties.

---

[2] Cochran, W. G. Sampling techniques. New York, John Wiley & Sons, Inc. 1963 p. 93.

[3] Cochran. Sampling techniques. p. 163.

30

SURVEY DESIGN

NIACC and DEQ jointly agreed that approximately 25% of the interviews should be conducted on-site with the remainder being completed by telephone. It was felt that the on-site interviews would not only give the interviewers a rapid familiarization with industrial processes, but would also increase the amount and degree of accuracy of data gathered from the larger firms. For this reason on-site visits were directed toward the larger industries; however, an attempt was made to keep the ratio of industries in any given area and SIC the same in the on-site sample as in the telephone sample.

Prior to the actual interview procedures, each interviewer received detailed instructions concerning the survey objectives, features of the hazardous waste stream in Iowa and general concepts of conducting successful interviews. Such training facilitated interviewers in establishing an atmosphere of confidence and cooperation, demonstrated by the high rate of response.

On-site interviews were arranged by geographic location to facilitate three interviews per interviewer per day. One week prior to the start of interviewing, selected industries were notified by mail giving details of the survey and asking them to participate. Once the selected industries had been notified, interviewers attempted to secure confirmed appointments by telephone for one full week, prior to leaving the office. However, this proved very time consuming since some firms were unable to confirm appointments during a given week or were unable to confirm appointments without calling back during the week.

For this reason it was determined one person should concentrate on making appointments for all interviewers. By doing so interviewers were able to make more efficient use of their field time and complete more than 51% (244) of the interviews on-site as opposed to the required 25% (154). The remainder of the interviews or 239 firms were either completed by telephone or had been completed by the industry and returned by mail. However, numerous follow-up telephone calls were necessary to clarify data or secure data which were not available at the time of initial interview. Additionally, every attempt was made to contact larger industries on-site who had responded by mail declining to participate in the survey. Where an on-site visit was not possible, those firms were contacted by telephone and urged to respond. This resulted in obtaining information from several firms who had indicated earlier they did not wish to participate. Only in a few instances did the interviewers feel they did not obtain accurate information from employers either at on-site interviews or from telephone interviews.

The major difficulty, particularly with smaller firms, was in conceptualizing "hazardous materials". Many of those interviewed had worked with such substances over a period of years and did not recognize or identify them as being "hazardous" within the definitions provided. Most of the information provided to the survey interviewers represents a "best judgment" by the plant manager or the plant's environmental engineer in the case of large firms, or the owner or working foreman in the case of small companies. However, in some instances those being interviewed were able to produce detailed records upon which they based their responses.

Of the 594 industries surveyed approximately 90% (483) responded. Of the remaining 111 firms, 62 refused to participate, 39 were out of business or had moved from the state and 10 firms were duplicates in the sample, that is, appeared twice under slightly different names. Of those responding, 113 companies indicated they did not use nor dispose of hazardous materials. In some instances this response may be questionable since other companies manufacturing similar materials in identical SIC groupings reported using substances and generating wastes with the characteristics defined.

In addition to the employer questionnaire, those industries visited on-site were asked to have a minimum of one employee who worked with hazardous material complete an employee questionnaire concerning his contact with and knowledge about the substances he handled. From the 244 on-site visits we obtained a total of 98 complete employee questionnaires from 65 different industries.

Survey Instruments. A five-page questionnaire for employers was developed to be used both for on-site and telephone interviews. (See Appendix A) Detached instructions containing definitions were developed and mailed to the firms being sampled approximately two weeks prior to the interview.

In addition to developing definitions for the types of substances to be included in the inventory, it was necessary to develop a method for cataloging job categories and job activities or functions.

The Dictionary of Occupational Titles, Volume II, Section on "Worker Trait Groups Within Areas of Work" was used to identify major job categories. The following traits were considered: work performed, worker requirements, clues for relating applicants and requirements, and training and methods of entry. After deleting those areas of work not applicable to this study, the remaining areas were consolidated into eight "worker trait groups" by the following criteria:

ADMINISTRATION

Those who control supervisory personnel and see that administrative principles, practices and techniques are carried out. Usually little contact with main workers.

SUPERVISORY

Those who supervise and coordinate activities of workers so as to control specific phases of plant production. Constant contact with workers he is responsible for.

CLERICAL

Those whose main function is preparing and dispensing facts, figures and schedules.

PROFESSIONAL

Those who provide advice and improved methods to those previously mentioned.

INSPECTOR, CHECKER, SORTER

Those who see that quality standards are maintained and in some instances variations in products are separated. Also examine material and supply stores while compiling records.

CRAFTSMAN

Those who demonstrate above average individual manual skills along with knowledge and judgment of associated materials, tools, principles and processes.

MACHINE CONTROLLER, TENDER, DRIVER OR OPERATOR

Those working with machines, knowing capabilities and functions of machines while using judgment as variable conditions and requirements are encountered.

HANDLER

Those who perform routine, non-machine tasks requiring varying degrees of dexterity and generally little judgment.

Job functions for workers were determined by application of requirements for the life cycle of hazardous substance from generation, handling, use, transporting, storage and disposal.

The instrument allowed industry to record waste volumes in a generation rate and unit of measure most convenient to their own record keeping. A conversion to the metric system was made during tabulation.

The employee questionnaire was limited to two pages and used for on-site visits only. Information recorded was generally limited to work requirements, training and education background, and to substances daily handled. The employees were asked to rate themselves and others with whom they worked in the same general areas of competencies as were the employers. (See Appendix A)

Limitations of the Study. The conceptual model and research methodology had several limitations which constrain the universality of the findings and conclusions. Some of the more important limitations are summarized below.

First, the use of SIC codes in identifying firms to be surveyed in studies such as this is probably the most common and the economical approach for identifying the universe. However, it does have several limitations which must be recognized. Through on-site visits it became obvious to interviewers there existed wide variations in industrial processes within any given SIC, and that these variations play a dominant role in determining which materials are used and how much waste is generated by their use. It also became obvious that the method in Iowa of determining or assigning SIC codes, based on a firm's industrial activity, resulted in misclassifying several industries for the purpose of this study. Of the 483 firms responding to the survey, 113 indicated they did not use nor dispose of special substances. In several instances these firms were distributors or wholesalers; some were small service shops. Generally speaking, misclassification occurred in smaller operations rather than in major companies although this was not true in every case.

The research methodology employed in the study had several limitations which restrict the generality of the findings. Since participating in the study was voluntary, non-respondent bias might affect the findings of the study. Also anonymity was a key factor in encouraging cooperation from industry, and interpretation of the materials and wastes types was essentially by the individual company representatives. Even though the survey provided uniform definitions to be used in categorizing waste types, individual differences in the perception of these definitions introduced a high degree of randomness. The subjectiveness of the categorizations of substance and waste types is further influenced by what may have been an assumption on the part of respondents whose interpretation of the input streams to a particular process produced waste data assigned essentially identical characteristics. Did they assume, for example, that waste would have the same characteristics as the parent compounds, or did they recognize that starting with perhaps innocuous materials the industrial process itself could have as an end product a substance for disposal that would fall within the definitions of the study? One could assume categorization of waste types might reflect the problem priorities of the respondents.

At times some industries had difficulty in estimating amounts of special substances within their total waste streams. Some contract with private haulers to dispose of their wastes regardless of characteristics and others mix both liquids and solids of different types before disposing of them. Every effort was made to obtain such estimates; however, in some cases it was necessary to place the total waste (considered as hazardous) under its most probable characteristic. In those instances where a waste material can be represented by more than one type, the primary type of waste category was applied and the volume reported only once.

In other cases exact quantities of wastes generated were not precisely known but were estimated based on such things as number of contract pick ups per month, quantities of new materials purchased and consumed, and size of storage facilities. Although much of the waste was described in terms of 55 gallon drums or gallon cans, the DEQ elected to measure the volumes of waste in metric units. Therefore, standard units for estimating density were developed by DEQ and applied to similar materials. Likewise, production points that discharge unpretreated wastewater to municipal sewers, or otherwise do not have facilities for contaminant removal prior to discharge, at times were unable to furnish precise figures on volumes. In these cases the quantities of materials consumed were generally used to estimate the amount of hazardous material remaining in suspension or solution in the discharge to the sewage system.

These kinds of variables and others must be recognized in looking at the data relating to types of substances. The survey design simply did not intend to produce a complete and precise description of the entire hazardous waste problem in Iowa. In order to get that type of absolute consistency and precision of data, it would be necessary to have authority to gather a great deal more precise information from industry including chemical makeup of their wastes and to have that data controlled and interpreted at one central point. This would be an extremely difficult and expensive task particularly when it is noted that the largest number of generators of special wastes are smaller employers presumably ill-equipped to provide technical data.

It should be noted in viewing the study data that biases were further reduced by subcontracting the design and conduct of the study to an independent private agency outside of the public sphere. The number of interviewers was held to four persons with three doing the bulk of the interviewing. In almost all other States where a similar study of the hazardous waste stream was undertaken, the study and analysis of data has been conducted by the State agency with regulatory and enforcement responsibilities. This approach would also experience difficulty in obtaining bias-free data since the agency priorities would certainly introduce a high degree of bias.

The confidence level of 95% obtained for the Iowa study and the tight confidence levels displayed on the tables may indicate that the randomness worked to the advantage of the study and produced reliable data for the volumes of both solid and nonsolid special wastes being generated in the State and the life cycle of that waste. This theory seems to be borne out to a degree in looking at the tables for employers of less than 100 employees and for those with 100 or more employees. Their collective decisions on interpreting the survey instrument appear to be very similar. The tables also indicate that the data breaks down well when displayed by quadrants with the tight confidence levels being maintained. This leads to the interesting suggestion that perhaps industry in their randomness can categorize their own waste better by type than anyone else can recognizing they obviously are individually biased but suggesting collectively they may represent the true value.

In sum, this study might never have been attempted if all the possible conceptual and methodological criticisms were resolved before it was undertaken. It is believed, however, that there is a sufficient theoretical base and related research to warrant concluding that the methodology provided an adequate framework for deriving significant new data and insights.

SUMMARY OF SURVEY FINDINGS

Manpower Characteristics Survey

Iowa workers in manufacturing are among the most productive in the nation. According to the 1976 statistical profile of Iowa as compiled by the Iowa Development Commission, each Iowa production worker surpasses the national figure for value added production by more than $3,900 each year.

The products and goods produced by these workers require the use of a great many raw materials and chemicals at nearly every step of the industrial process. Many of these materials are either hazardous in nature or may become hazardous in association with other substances.

Very little is known about the people who daily work with these materials, their worker traits, their educational background, or amount of training and information they receive about the nature of the substances they handle.

It is the production process itself that is the bridge between the materials used by workers and the generation of special or hazardous wastes. These wastes are present as raw materials, as discarded, unused or outdated materials; they may be generated in the production of other materials, or as by-products of unusable substances remaining from the production of other materials. However this waste comes into being, it is clear that a tremendous volume is being generated by the use of these materials and that this generation is costly to industry because of the costs incurred in disposal, and the loss of valuable raw materials and products. It is also clear that society as a whole is being affected by this loss, not only in terms of a less clean and healthy environment, but also in the dollar costs of these wastes, which must ultimately be absorbed by the selling price of a marketable product. There is an interrelationship between society and industry, since from the top of the corporate ladder to the production line worker, industry is made up of human beings who must make decisions regarding their particular industry, and who are also members of society as a whole. Thus their lives, their world and its environment, and their economic well-being are bound up inexorably.

This study set out to find out:

1. Who are these workers; are they supervisory personnel or less than supervisory?
2. What are the general job categories of workers who handle special substances?
3. How long have they been with their present company and what functions do they perform?
4. What is the formal educational background of the workers?
5. What amount and what type of training are they given by their employer which is specifically related to the substances with which they work?
6. How many workers in Iowa daily handle special substances as a part of their employment?

SUMMARY OF SURVEY FINDINGS

The following definition of special substances was used in making these determinations:

> "Substances or materials which require careful handling so as to protect the well-being of the worker and his environment. They generally are hazardous under certain circumstances."

Materials were typed by the same categories used for estimating characteristics of waste generation. These types were then carried through for recording all data.

In order to facilitate a more informative discussion, data has been arrayed by waste types and by SIC groupings. Tables, unless required for clarity in the body of the report, have been placed in the Appendices and appropriately referenced in the text.

The confidential nature of much of the information prevented the association of any data with a specific firm. If any SIC or substance type group contains less than five firms, no data has been displayed.

Location of Firms and Employees. An estimated 69% or 16,597 employees in Iowa who daily contact hazardous substances are performing a function with a flammable substance. An estimated 41% or 9,839 persons daily in contact with hazardous substances work with a toxic substance; 27% or an estimated 6,459 are in contact with substances identified by their employer as being predominantly corrosive. Other substances are daily contacted by less than 10% of these workers.

The majority of workers are employed in firms located in the eastern half of the State. This is true for all types of substances except pathological. Firms located in Quadrants I and IV consistently employed more workers who handled hazardous substances on a daily basis. Quadrant II employed fewer persons in this category and in fewer firms using hazardous substances than did any other quadrant.

Even though more of such workers were employed in firms in Quadrants I and IV than in the other quadrants, a comparison of firm locations and numbers of workers employed in these areas indicates that firms handling a particular type of hazardous substances were no more likely to be located in one quadrant than in another. The use of explosive-reactive materials was reported by a substantially greater number of firms in Quadrant IV. The percent of workers daily handling hazardous substances was generally consistent with the number of estimated firms handling such substances. Differences are probably attributable to the size of firms within each quadrant or to the willingness of firms to fully report information. The major deviation from this is in the use of corrosive materials as follows:

SUMMARY OF SURVEY FINDINGS

	Quadrant I	Quadrant II	Quadrant III	Quadrant IV
% of all firms estimated to handle	20	25	19	36
% of all employees estimated to handle	23	9	14	54

From this it may be assumed there are a greater number of small firms in Quadrant II who use corrosive substances, and a greater number of large firms in Quadrant IV using corrosive substances than in the other two quadrants. Tables displaying the estimated numbers in each quadrant of firms and employees handling these substances by type of substance appear in Appendix B as Tables 1 and 2.

For an estimate of the number of firms handling hazardous substances classified by type of substance handled, broken down by major group standard industrial classification, see Appendix B, Table 3.

Size of Companies. There was no significant difference by size of company in the use of hazardous substances by the type of substance in use other than pathological substances which had a significantly fewer average number of employees in daily contact per firm.

The average number of employees per firm who are in daily contact does vary widely however, when looked at by SIC major groupings. Employers classified in Agricultural Services (07), Lumber and Wood Products (24), Printing, Publishing and Allied Industries (27), had the lowest average number of employees in daily contact. Employers classified in Rubber and Miscellaneous Plastic Products (30), Primary Metal Industries (33), Machinery, Except Electrical, and Electrical Machinery, Equipment, and Supplies (36) had the greatest average number of employees per firm in daily contact. It is interesting that the firms classified in Major Groups 07, 24 and 27, with the fewest average number of employees in daily contact, also generate a small percentage of the annual volume of special wastes in Iowa (although Major Group 27 contained 36% of the firms generating these wastes). Of the firms classified in Major Groups with the greatest average number of employees daily in contact, those in Major Group 36 generate 43% of the nonsolid waste, although only 2% of the solid wastes are disposed of annually in Iowa (See pages 71 through 83; Wastes by SIC Groupings). Firms classified in Major Group 28 (Chemicals and Allied Products) have an average of 17.3 employees per firm daily handling hazardous substances, and generate 32% of the solid waste and 23% of the nonsolid wastes. These averages are of interest only in that they are an indication of the possible number of employees contacting all types of substances in firms who, because of SIC groupings, can be expected to utilize varying industrial processes. This information may be useful in designing training programs. It should be noted these averages are determined by the sample which contained employers with 0 numbers of employees and those with more than 1,000; therefore, the actual number of employees who may daily contact hazardous substances will vary widely within all these classifications.

SUMMARY OF SURVEY FINDINGS

The average number of employees handling hazardous substances per firm by all types of materials for each SIC classification appears in Appendix B as Table 4. As noted before, there is little difference (other than pathological) in the averages by type of substance handled; variances occur by major groupings of firms. This suggests that training needs might better be identified and grouped by types of materials in use with supplemental needs identified according to the specifics of the industrial processes in use within SIC groupings.

Percent of Work Force Contacting Hazardous Materials. This study did not seek to determine the amount of daily exposure nor the conditions under which it takes place, although employees interviewed were asked the number of hours of their contact each day. It is probably of greater interest to note the percent of workers in each SIC who experience some daily exposure, since one can hypothesize that daily exposure increases the risk associated from accidents or environmental factors. The percent of the work force within manufacturers included in the study who daily contact these substances is estimated as follows:

SIC GROUP	ESTIMATED NO. OF FIRMS USING HAZARDOUS MATERIALS	% OF WORK FORCE DAILY CONTACTING HAZARDOUS MATERIALS
ALL FIRMS	2,021	20%
07	413	63%
24	36	32%
26	25	20%
27	707	20%
28	318	35%
30	22	25%
33	36	26%
34/39	349	19%
35	67	8%
36	34	28%
Other	14	13%

Thus it can be seen that in industries who use hazardous or special substances, a substantial percentage of the total work force daily contact these substances. In computing the total work force, firms were asked to record the total number of people employed at the plant site as indicated by personnel records. This included all positions; managerial, technical, clerical, plant workers, maintenance, etc.

The total number of firms using special substances in Iowa is estimated to be 2,021. The geographic distribution of these firms by type of material used is displayed in Appendix B, Table 1. Table 2 in Appendix B displays an estimate of the number of employees who handle hazardous substances Statewide and for each quadrant by the type of substance. An individual firm or an individual employee may handle more than one type of substance; thus these totals are nonadditive.

Job Categories and Job Longevity. According to survey results, an estimated 24,031 workers in Iowa daily handle special or hazardous materials. (See Table 4)

TABLE 4

ESTIMATED TOTAL NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Estimated number of employees handling hazardous substances*
07	1,244 (866-1,622)
22,29,31,32,37	160 (75-245)
24	244 (111-377)
26	686 (541-831)
27	3,299 (2,494-4,104)
28	5,500 (4,255-6,745)
30	1,467 (401-2,533)
33	2,259 (2,116-2,402)
34,39	4,942 (4,207-5,677)
35	2,635 (507-4,763)
36	1,595 (1,236-1,954)
Total	24,031 (20,996-27,066)

*The 95% confidence interval is shown in parenthesis below the estimate.

This means that 20% of the people employed in manufacturing industries in Iowa[4] daily come in contact with hazardous materials as a part of their employment. Of this number, 15% or 3,633 individuals are at the supervisory level and above or are trained as professionals. The remainder of 20,398 or 85% are less than professional or supervisory level workers.

The largest number of these workers, 10,512 individuals or 45% of all those handling, are machine operators. They have an average of 6.4 years with their company and 5.97 average years at their present job. They are relatively stable in the work force within their companies, since the average number of replacements per year is estimated at 1.82 workers per firm. By far the majority are handling flammable or toxic substances or both.

By combining the estimated total number of operators with the number of craftsmen and handlers estimated to handle special substances, we find that 19,771 or 82% of all individuals working with such substances are in these three categories of workers. The substance types they predominantly work with are flammable, toxic or corrosive. The work force is relatively stable with little turnover and few new hires per firm per year. Thus it could be assumed the amount of exposure is present over a number of years.

Individuals with the greatest amount of job longevity, however, are management, supervisory or professional level employees. The average replacements per year and the projected needs for next years are lower than those for less than supervisory or professional levels. The estimated numbers of employees by job classifications and job longevity are further broken out and displayed on Table 5 in Appendix B.

The study did not identify any one job category as being more likely than others to contact hazardous substances. Professional positions are more likely than other categories to handle pathological substances, but in some instances workers in the handler category also daily contact such substances. Workers in the handler category were the only employees to have contact with all substance types. More firms were estimated to employ operators to handle flammables, toxics and corrosives than any other position. The estimated number of firms with one or more employees handling hazardous substances by position and type of substance handled is detailed in Appendix B, Table 6.

Job Functions. One of the objectives of the manpower component of the study was to secure a "qualitative description of the manpower characteristics of persons involved in the hazardous waste stream...in terms of their work and responsibilities.."

This requirement was interpreted to ask the question, "What do workers handling hazardous substances do with the materials they use?"

---

[4] 1976 Statistical Profile of Iowa, Iowa Development Commission, (Iowa work force 1974 1,267,600) p. 11.

SUMMARY OF SURVEY FINDINGS

In order to answer this question, the following tasks were identified as being a function related to the life cycle of hazardous substances.

Supervise:	Assists other workers and management in solving work problems while coordinating activities of workers.
Receives:	Accepts materials to be used, stored, distributed, or shipped. Performs such duties as opening cartons, cans or sacks and verifying contents.
Loads:	Fills or empties materials from or into various vessels, e.g., tank cars, vats within plant, kilns, compressed gas cylinders, processing machines, etc.
Mixes:	Combines, either by hand or machine, solid, liquid and/or gas ingredients to make products or solutions of proper concentration.
Charts:	Records on appropriate forms such statistics as materials used, products produced, etc., or may change charts on measuring instruments such as pyrometers and flowmeters.
Packages:	Containerizes products or materials into anything from bottles to wooden boxes either by hand or machine. Usually seals container and applies labels.
Applies By Hand:	Coats a material, usually a part of ultimate finished product, with another material by immersion, hand spraying, rubbing, etc.
Applies By Machine:	Coats a material, usually a part of the ultimate finished product, with another material by operating or tending a machine.
Stores:	Temporarily assembles various substances, materials, or products into a designated area until further routing is indicated.
Processes:	Performs any combination of tasks which affects a change in a substance or material.
Transports/ Moves:	Relocates substances, materials or products by hand carrying, operating an industrial truck or tractor, controlling a conveyor system, operating a crane or driving a dump truck, semi-truck, etc.

SUMMARY OF SURVEY FINDINGS

Disposes: Gets rid of wastes (by-products, off specification products, packing materials, etc.) by pouring into sewer or waste containers, loading it into vehicles, by burning, baling, etc.

Employers were asked to identify the number of functions performed by employees in each of the job classifications identified for the study by type of substance used. Estimates were then made for the number of firms with one or more employees handling hazardous substances for each of the job functions.

In order to be considered as a broad-based and generally performed function of employees in their handling of hazardous substances for any one job category, it was arbitrarily decided that a minimum of 50% of the firms must have at least one worker who performed that function. After applying this criteria, the following job functions were established for each category of employees in his/her handling of hazardous materials.

Professional and Supervisory Levels:

Administrator	Supervisor	Professional
1) supervises	1) supervises	1) supervises
2) receives		2) receives
3) loads		3) mixes
4) applies by hand		4) applies by hand
5) stores		5) disposes
6) disposes		

Less Than Supervisory Levels:

Clerk	Inspector	Craftsman	Operator	Handler
1) receives	0	1) applies by hand	1) loads	1) transports
2) stores		2) applies by machine	2) applies by machine	
		3) disposes		

If the arbitrary number of functions necessary to be performed in order to be accepted as a general function is reduced to 40% of the firms, the following functions would be added to the above categories of employees:

Professional and Supervisory Levels:

Administrator	Supervisor	Professional
7) mixes	2) receives	6) loads
8) charts	3) transports	7) stores
9) applies by machine		8) transports
10) transports		

SUMMARY OF SURVEY FINDINGS

Less than Supervisory Levels:

Clerk	Inspector	Craftsman	Operator	Handler
3) transports	1) other	4) receives	3) receives	2) loads
4) disposes		5) loads	4) mixes	3) applies by hand
		6) mixes	5) applies by hand	4) stores
		7) transports	6) transports	
			7) disposes	

Thus it can be seen that administrators who daily contact hazardous substances perform more functions (10) with the substance than other categories of workers, although professional employees and those employed as craftsmen and operators also perform a variety of functions. Supervisors, clerks, inspectors and handlers perform fewer tasks. A complete breakdown of all categories of workers and their job functions is displayed in Appendix B as Table 7.

In order for generally assigned job functions to be better understood in relationship to their implications for training needs, it is necessary to note the percentage of firms estimated to employ at least one or more employees who handle hazardous substances in each of the job categories to wit:

	% of Firms Employing
Administrators	19
Supervisors	28
Clerks	7
Professionals	20
Inspectors	2
Craftsmen	34
Operators	42
Handlers	34

When the number of job functions performed by each category of worker is looked at in relationship to the percentage of firms employing persons who handle hazardous substances in each category, the need for training for craftsmen, operators and handlers becomes apparent. Craftsmen and operators are performing a significant number of functions with hazardous substances in a substantial percentage of firms; and handlers are the only job category to have contact with all types of substances.

Education and Training. The acute need in this nation to deal with the pressing problem of a clean and healthful environment must take into account the dual need to make progress toward greater productivity and improved quality in our economic society. People are one of the great resources in dealing with these dual goals; consequently their background and training becomes increasingly important.

One of the purposes of this study is to present a broad and general description of the manpower characteristics of persons who are employed in industries who use or dispose of special or hazardous materials. Another purpose is to determine the amount and type of training they receive.

SUMMARY OF SURVEY FINDINGS

For purposes of this discussion, "training" includes all activities and efforts which are aimed at increasing an individual's ability to do his job as it relates to the use of the particular substance or substances identified in the study.

Employer Provided Training - Amount and Type. Better than 80% of employees who daily contact special substances have a high school education, its equivalent, or less. An additional 11.3% have some post secondary education while 5.4% have a college degree and 2.5% have graduate training. Since the study showed better than 80% of employees daily contacting are at less than supervisory level, it became increasingly clear the responsibility for proper training rests with employers. (See Appendix B, Table 8)

Some industries, particularly large firms, have one or more staff members assigned to training on a full-time basis. In smaller firms this responsibility is generally assigned a supervisor or foreman as a part of his overall assignment. Training often becomes a "line responsibility" with supervisory personnel training by "example". In this sense training continues as long as new situations arise and rests primarily on daily experiences in carrying out job duties.

Interviewers generally felt that most personnel employed in less than supervisory positions received informal training by example. This training is on-the-job and involves such things as receiving instructions, correcting errors, handling requests and making plans with the supervisor for improving or changing some part of the job. Thus informal training would not be comprehensive in scope as far as focusing on the use or misuse of hazardous substances, and planning to increase the employees' general and specific knowledge about the characteristics of the substances with which he works.

Large companies also may schedule periodic meetings with production workers in which safety and emergency procedures are discussed.

The study estimates that only 40% of firms using hazardous substances provide informal training. The length of this training is estimated to be approximately 57 hours or less per employee.

Very little formal classroom training is provided; less than 10% of the firms included are estimated to provide this type of training. Interviewers tended to believe that where it was provided it was generally given to supervisory personnel and above. Structured training given on-site on an on-going basis did not differ significantly in number of hours from that provided off-site. However, when training was provided on a one-time only basis, the training provided off-site was of a significantly greater number of hours than any other type of structured training. An estimated average length of training programs for all firms and for firms in each quadrant appears in Appendix B, Table 9.

Structured or classroom training may be ongoing in nature in that personnel meet regularly for the purposes of receiving new information, improving their job skills and developing understanding about specific operational policies and problems. This training often takes the form of meetings in which prepared material is presented and group discussion is held to increase supervisory skills. In this context, particularly difficult problems associated with the use of hazardous materials and consequences of misuse of materials would be dealt with. A wide variety of training techniques and aids would be employed.

Off-site classroom training generally consists of personnel being sent to training provided by suppliers of raw materials, and is much more specific regarding the use or misuse of a product. It would be safe to assume, however, that supplier training would tend to concentrate on the positive results that could be expected from a specific product.

The study also sought information related to general subject areas being covered by employer provided training programs. (A table estimating the number of firms having training programs in five general areas as well as those reporting none appears as Table 10 in Appendix B.) Approximately 814 or 40% of employers are estimated to provide no training in such areas as safety, recognition, vocational, supervisory, or first aid while 1,207 or 60% have at least one program. Safety programs are estimated to be offered by 775 or 38% of the firms and was the training program estimated to be offered by the greatest number of firms. There were 435 firms or 22% offering training in recognition, the next highest number of programs.

In a limited survey of employees in firms where employers agreed to the participation of their personnel, the employees were asked about their participation in training programs in the same general area. A comparison of estimated responses from employers in the total universe to actual responses of employees shows the following:

	% of Employers Providing Training Programs	% of Employees Indicating They Received Training
Safety	38	45
Recognition	21	27
Vocational	17	21
First Aid	16	24
Supervisory	12	14
Other	4	02
None	40	10

The above comparison would seem to indicate that more persons known to have received training completed the employee questionnaire than did employees who did not. However, the percentage responses appear to compare favorably.

Table 5 is an analysis of the characteristics of individuals participating in the employee survey. Their average years with their company and the average number of years at their present job compares favorably with those presented in Appendix B, Table 5, for the total universe at the administrative, supervisory and professional levels as well as at the generally nonsupervisory levels of clerk, inspector, craftsman, operator and handler.

TABLE 5

MANPOWER AND TRAINING CHARACTERISTICS OF EMPLOYEES WHO INDICATE DAILY CONTACT WITH HAZARDOUS MATERIALS

	Supervisory	Less Than Supervisory	Sample Size
Total No. of Employees Interviewed	45	53	98
Average Age	40.5	36.2	86
Average Years Formal Education	12.9	11.5	98
Average Years With Company	14.3	8.8	98
Average No. Years at Present Job	7.4	6.5	97
Average Hours Contact Daily With Hazardous Material	3.8	3.9	83
Average No. Different Types of Hazardous Material Contacted Daily	1.9	1.4	98
Average No. Hours Job Related Training Received	15.9	4.2	76

Percentage of Employees Reporting:

a. Formal Training (Classroom)	7%
b. Informal Training (Hands-on)	84%
c. On-going Training	55%
d. One-time Only Training	21%
e. Other Training	--
f. None	10%
g. Don't Know	02%

Employees at these levels report similar amounts of daily contact with hazardous substances; however, as might be expected, supervisory personnel report almost three times as many hours of training each year than do nonsupervisory personnel. Supervisory personnel also have the greatest amount of formal education. From this we may assume there is a larger number of individuals daily contacting hazardous substances who have a high school education or less, than there are those with more than high school education, and that the less educated receive less training from employers than do those with more formal training.

Competencies of Employees. In recent years there has been a greater recognition of training as a management tool. This is particularly true in industries who follow a policy of "promotion from within". Additionally, governmental policies, rules and regulations specifically require training for employees in certain instances, e.g., Occupational Safety and Health Act.

Along with a recognition of a need to provide training for employees, industry has had to better define the competencies they expect employees to possess. These are generally linked to job categories and job skills. Skilled mechanics, operators, craftsmen, etc. are expected to possess some prerequisite skills, although it is rather generally accepted that individuals seldom bring to their jobs all the knowledge, skills and understanding needed to perform all tasks. In this sense training may be viewed as a comparison between the requirements of work assignments and the qualifications of employees and a supplying of the gaps in understanding and knowledge.

One of the broad general purposes of this study was to obtain a subjective evaluation of the manpower characteristics of employees in relationship to the requirements of industrial generators of hazardous wastes.

To accomplish this purpose it was agreed early in the project that it would be highly desirable to develop a limited list of competencies which would be generally applicable to persons who were involved with handling, transporting or disposing of hazardous substances. By having industries rate their work force handling special substances as above average, adequate, needs improvement or not applicable to their operation, it would be possible to make some subjective determinations of these lacks or gaps in understanding and knowledge. Since no such listing was available, the project developed a "common sense" approach to competencies which were based on law or regulations. Five of these were believed to be universally applicable to all firms, while 13 could be related to industrial activity or processes. Three were most applicable to firms who transported hazardous substances including wastes.

A secondary purpose of this approach was through evaluation of the responses assist NIACC to assess probable areas of training needs.

Analysis of Employer Competency Ratings. Employers were asked to rate their employees who handle hazardous substances in the following competencies:

a. Technical knowledge.
b. Knowledge of rules and regulations pertaining to handling, storage, disposing of HM.
c. Compliance with company policies, rules and practices.
d. Knowledge of classes of HM, proper DOT shipping names, packaging, labels, marking and documentation requirements.
e. Familiarity with the "Loading and Storage Chart" of the Department of Transportation.

f. Knowledge of safety requirements in various work areas.
g. Ability to recognize by name substances restricted by law.
h. Knowledge of hazardous chemicals and their uses.
i. Knowledge of noncompatible substances and reactions.
j. Knowledge of relationships between HM, irritants and allergies.
k. Ability to recognize agents causing potential health problems and proper precautions.
l. Knowledge of the proper procedures for handling, disposal and/or decontamination in case of accident or incidents.
m. Knowledge of attendance requirements when hazardous substances are being transported.
n. Ability to report full details concerning any incident, including detailed information as to cause, damage and corrective action taken.
o. Knowledge of what information to pass on to firemen, police and others should an emergency arise.
p. Knowledge of sources of help and information to be used when emergencies occur and when unrecognizable chemicals are encountered.
q. When damaged containers are discovered, ability to isolate and take proper measures for further transportation.
r. Knowledge of proper fire prevention and extinquishing measures.

It was recognized from the beginning that several factors would influence how any given individual responded to the questions. Did they consider hazardous waste a serious problem at their plant? Did they give sufficient time to answering the questions? Had they studied the questions prior to answering them? All these factors could affect responses. For that reason one should keep in mind an important fact while reading this analysis--percentages are not absolute. They represent similarities and dissimilarities between questions and subject areas.

Table 6 compares responses to the 18 individual questions for the total universe. Each category represents the percentage of responses from the universe falling in that particular category. At a glance, questions having the highest rating can be identified. For example, question C, "Compliance with company policies, rules and practices," has the highest percentage of firms rating their employees "above average" while question J, "Knowledge of relationships between HM, irritants and allergies," has the highest percentage indicating their employees "need improvement."

TABLE 6

TOTALS FOR EACH QUESTION
% STATEWIDE

	Above Average	Adequate	Needs Improvement	Not Applicable
a	30.2	51.5	9.4	8.9
b	26.4	50.0	13.2	10.4
c	43.4	45.8	5.2	5.6
d	7.1	32.8	11.2	48.9
e	7.2	25.9	11.3	55.6
f	37.0	53.3	5.7	4.0
g	17.9	34.8	24.9	22.4
h	16.5	43.0	19.5	21.1
i	12.4	33.4	26.8	27.4
j	12.8	35.6	32.3	19.3
k	17.9	41.8	26.5	13.7
l	21.6	48.1	17.3	13.0
m	11.3	33.2	9.9	45.6
n	29.7	51.4	8.3	10.6
o	33.4	52.2	6.3	8.1
p	22.0	50.0	16.3	11.6
q	19.2	46.5	12.2	22.1
r	37.2	50.7	7.5	4.6

An analysis was also made of the above questions for each of the quadrants within the State to determine if geographic differences in responses might exist. There was very little variation between areas of the State for any of the questions.

One of the purposes of the project was to identify areas for possible course development should the study indicate a need. To facilitate identification, five major subject areas of interest formed the basis of competency evaluation. These were: Recognition and Use; Handling, Storage and Disposal; Health; Transportation; and Emergency Information.

By combining responses to questions around these groupings, particular strengths and weaknesses become more clearly understood. Table 7 is the result of such a combination and again the figures represent percentage of total responses. Such an examination immediately shows the great variation between subject areas and particularly the needs improvement category. Recognition and health (for an examination of the particular questions involved in the subject area refer to individual questions), show a significantly higher percentage of responses in the "needs improvement" category than do the other three categories. It would appear rather presumptuous to state, however, that any given level of response in the "needs improvement" category shows a definite need for the development of training programs, but the obvious differences between these two categories and the others certainly indicate an awareness of additional needs in these areas.

TABLE 7

EMPLOYER EVALUATION OF
COMPETENCIES BY COURSE GROUPINGS
TOTALS FOR ALL QUADRANTS, SIC'S & SIZE

	Above Average	Adequate	Needs Improvement	Not Applicable
Recognition (GHI)	16%	37%	24%	24%
Handling, Storage & Disposal (BEL)	18%	41%	14%	26%
Health (JK)	15%	39%	29%	16%
Transportation (DMQ)	13%	37%	11%	39%
Emergency Information (NP)	26%	51%	12%	11%

Also of interest, and possibly more significant, is the high percentage of responses falling into the "not applicable" category. Although some employers simply state not applicable as an easy alternative to serious consideration of the questions, most employers who responded in this category truly felt the subject area did not apply. It becomes a bit of a subjective argument to explain why certain subject areas may or may not apply, but the two areas having the lowest percentage of responses in the "not applicable" category are subject areas involving Health and Emergency Information--areas in which the employer is most likely to be held personally liable in cases of accidents or injury. It could be argued that the other areas are similarly applicable but are not recognized as being so, and therefore represent a greater need for improvement than do the two recognized areas of health and recognition. This is a question which deserves further study and can possibly be determined with additional communication developed between industry and educators as a result of pilot training programs.

An analysis of the groupings in the above table, if broken down by area school quadrant, would show a rather surprisingly consistent need or awareness of need for improvement in the areas of health and recognition of hazardous materials and waste in all areas of the State.

Table 8 does not contain new information but rather a new way of examining the data. The table is a comparison by subject area between SIC groupings within the universe. Such a division seriously reduces the sample sizes in some categories.

TABLE 8

EMPLOYER EVALUATION OF COMPETENCIES
WITHIN STANDARD INDUSTRIAL CLASSIFICATION
OF FIRMS BY COURSE GROUPINGS

SIC	07	22	24	26	27	28	30	33	34	35	36
Handling, Storage & Disposal (BEL)											
Above Average	.25	.17	.60	.16	.11	.28	.03	.16	.16	.16	.11
Adequate	.35	.67	.02	.41	.40	.52	.52	.45	.45	.35	.47
Needs Improvement	.06	.17	.06	.16	.18	.15	.18	.07	.13	.21	.20
Not Applicable	.34	--	.32	.27	.31	.05	.27	.31	.26	.27	.21
Health (JK)											
Above Average	.34	.50	.35	.08	.09	.12	--	.11	.13	.04	.03
Adequate	.36	--	.01	.36	.31	.46	.70	.31	.50	.43	.55
Needs Improvement	.20	.50	.07	.22	.40	.31	.16	.39	.20	.29	.39
Not Applicable	.09	--	.57	.34	.20	.11	.14	.19	.17	.23	.03
Transportation (DMQ)											
Above Average	.18	--	.54	.15	.06	.20	.02	.07	.12	.05	.05
Adequate	.32	.17	.04	.40	.32	.54	.52	.32	.44	.36	.39
Needs Improvement	.07	.50	.23	.07	.11	.14	.06	.12	.10	.15	.32
Not Applicable	.42	.23	.19	.39	.52	.12	.41	.49	.34	.43	.23
Emergency Information (NP)											
Above Average	.33	.25	.68	.20	.22	.32	.07	.15	.20	.22	.03
Adequate	.42	.50	.17	.48	.53	.51	.77	.54	.56	.47	.53
Needs Improvement	.07	--	.01	.12	.13	.14	.05	.11	.13	.27	.41
Not Applicable	.17	.25	.14	.20	.11	.03	.11	.19	.11	.04	.03
Recognition (GHI)											
Above Average	.32	.50	.10	.03	.06	.23	--	.06	.13	.06	.08
Adequate	.40	--	.01	.36	.33	.50	.45	.30	.34	.28	.35
Needs Improvement	.14	.50	.26	.22	.34	.17	.23	.27	.18	.37	.44
Not Applicable	.15	--	.63	.39	.27	.10	.32	.38	.34	.28	.12

An examination of the tables shows striking similarities of ratings within subject areas regardless of the SIC. These similarities strongly suggest that very dissimilar industries using highly variable manufacturing processes have similar training needs, needs which must center around particular materials common to several types of industries rather than around specific manufacturing processes.

Table 9, a comparison between large (more than 100 employees) and small (less than 100 employees) industries and the five subject areas shows no significant differences between the two size groupings, although smaller industries consistently indicated a lower percentage of need improvement for every category.

TABLE 9

EMPLOYER EVALUATION OF COMPETENCIES GROUPED ACCORDING TO SUBJECT AREAS BY SIZE OF FIRM
STATEWIDE

By Size <100

	Above Average	Adequate	Needs Improvement	Not Applicable
Health (JK)	.16	.38	.29	.17
Emergency Information (NP)	.27	.50	.12	.11
Recognition (GHI)	.16	.37	.23	.24
Transportation (DMQ)	.13	.37	.10	.39
Handling, Storage & Disposal (BEL)	.19	.41	.13	.27

By Size >100

	Above Average	Adequate	Needs Improvement	Not Applicable
Health (JK)	.08	.45	.32	.15
Emergency Information (NP)	.15	.58	.18	.09
Recognition (GHI)	.09	.36	.31	.24
Transportation (DMQ)	.10	.39	.18	.34
Handling, Storage & Disposal (BEL)	.16	.46	.19	.18

SUMMARY OF SURVEY FINDINGS

Analysis of Employee Competency Ratings. From 65 of the on-site interviews, employers gave additional information by having one or more employees complete the same set of competency questions. Employees were asked to rate themselves and their fellow employees on the average in the 18 competencies. A total of 98 completed forms were obtained for analysis.

Obviously this is a very small sample when considering the total number of employees handling hazardous materials, and it does not adequately represent some categories when divided for comparisons, but it does show the feelings of at least 98 individuals who handle a variety of hazardous materials.

As shown, employees were given one additional response to each competency--don't know. It was felt this would give employees an easy option for difficult questions since employees might legitimately be unable to answer some questions due to the limitations of their duties.

Keeping in mind then that this is a very small sample, several comparisons can be made from the tabulated data contained in Table 10 showing responses for those interviewed. An analysis of the same groupings by geographic areas failed to show any significant differences in employee responses.

TABLE 10

EMPLOYEE EVALUATION OF
COMPETENCIES BY COURSE GROUPINGS
TOTALS FOR ALL QUADRANTS, SIC'S & SIZE

	Above Average	Adequate	Needs Improvement	Not Applicable	Don't Know
Recognition (GHI)	15%	38%	25%	10%	11%
Handling, Storage & Disposal (BEL)	10%	43%	16%	17%	13%
Health (JK)	10%	38%	24%	11%	16%
Transportation (DMQ)	11%	36%	16%	22%	13%
Emergency Information (NP)	14%	46%	16%	10%	14%

SUMMARY OF SURVEY FINDINGS

Responses to all 18 competencies are presented in table form and will not be discussed further. The grouped questions are of course the same grouping as were the employer groupings.

An examination of the questions grouped by subject areas shows a striking similarity to the employer responses presented earlier. It will later be shown that the employer responses from which employee forms were obtained are statistically the same as the employee responses. Simply stated, employers and their employees answered the questions the same way. This is true not only within each quadrant but within the State. Without a great deal of additional time and expense, however, this cannot statistically be projected to the universe, but it is probably a very safe assumption.

Other information gathered from the employee forms was examined to determine if such things as job functions, time on the job, time with the company, age, size of the industry or manufacturing SIC classification affected the way in which an employee responded to all the questions.

To make these determinations, employee questionnaires were first divided into the appropriate categories. For example, to examine job functions, questionnaires were divided into handlers, operators, craftsmen, supervisors and professional. (Because some of the questionnaires were incomplete, they were not considered while comparing various categories. This was necessary so that the same group of employees could be compared each time.) Then, within each category, all those questions answered as "needing improvement" were counted and the total divided by the number of employees within the category. The resulting figure shows how many questions on the average each employee within the category answered as needing improvement. Averages were then compared using a one-way analysis of variance and a .05 significance level to determine if there were significant differences between categories. It should be noted that this procedure does not identify which questions were marked as needing improvement, but instead seeks to determine if a certain type of employee is more or less likely to indicate a overall need for improvement.

Table 11 is a division by job category. While it does show great variability, particularly between "handlers" and "craftsmen", the differences are primarily due to some individuals within the craftsman category marking "needs improvement" several times and other individuals marking it very few times if at all. In other words, no one as a group marked needs improvement statistically more or less often than any other group.

TABLE 11

JOB CATEGORIES

	Total Needs Improvement	Sample Size	Average
Handler	11	7	1.57
Operator	50	22	2.27
Craftsman	52	16	3.25
Supervisor	99	33	3.0
Professional	19	6	3.17

Table 12 is a division by the time an employee has been at his present job. A comparison between the categories does show one category as a group of individuals marking "needs improvement" statistically more often than two of the other groups. Employees at their present job from 4 to 7 years marked an average of 5.17 questions as needing improvement while new employees (0 to 3 years on the job) checked only 2.33 questions as needing improvement and those on the job from 8 to 11 years marked only 1.57 questions as needing improvement.

TABLE 12

TIME AT PRESENT JOB (YEARS)

	Total Needs Improvement	Sample Size	Average
0-3	98	42	2.33
4-7	62	12	5.17
8-11	22	14	1.57
12-15	16	6	2.67
16-19	8	3	2.67

Several reasons could be presented in explaining the difference, but it would seem logical to assume that these people have been with the company long enough to expect a promotion of some type and may be looking to better their prospects through more and better job knowledge.

Table 13 is a division by age classes and also contains a significant difference between two categories. Employees 36 to 40 years old marked only 1.30 questions as needing improvement while employees 41 to 45 years old marked 4.60 questions as needing improvement. Employees 46 to 50 approached the 41 to 45 age class by marking an average of 4.14 questions as needing improvement, but the difference is questionable in this case since it is not quite statistically significant. With only the present data it would be very difficult to hypothesize about reasons for the difference in two age classes so close together.

TABLE 13

AGE CLASSES

	Total Needs Improvement	Sample Size	Average
19-25	55	16	3.44
26-30	37	13	2.85
31-35	28	13	2.15
36-40	13	10	1.30
41-45	46	10	4.60
46-50	29	7	4.14
51-60	15	10	1.50
>60	12	7	1.71

Table 14 is a division by SIC codes. Only eight of the possible 18 classifications are represented because few if any employee forms were available from the other SIC categories. Although there are some variations none are significant at the .05 level, meaning that no one particular SIC group is more or less likely to mark a question as needing improvement.

TABLE 14

SIC

	Total Needs Improvement	Sample Size	Average
26	23	6	3.83
27	34	15	2.27
28	24	13	1.85
30	17	6	2.83
33	5	3	1.67
34	63	19	3.32
35	28	12	2.33
36	22	6	3.67

An examination of questionnaires by the size of industry from which it was obtained is shown in Table 15 and again does not show any significant differences between categories, although it would appear that employees from smaller sized industries (less than 100 employees) tended to mark a higher number of questions as needing improvement than did employees from larger industries (more than 100 employees). It should be noted this is the reverse of employer questionnaires.

SUMMARY OF SURVEY FINDINGS

TABLE 15

SIZE OF INDUSTRY

	Total Needs Improvement	Sample Size	Average
1-20	21	6	3.50
21-50	28	12	2.33
51-100	61	17	3.59
101-250	117	37	3.16
251-500	23	8	2.88
501-1,000	7	5	1.40
over 1,000	29	13	2.23

A summation of the analysis of the employee responses to the competency ratings can be displayed in the following table.

TABLE 16

OVERALL EMPLOYEE INDICATED NEED FOR IMPROVEMENT BY JOB CATEGORY

Job Category	Average Education	Average Time On Job	Average Time Spent Handling H/M Per Day	Needs Improvement
Supervisor	12.3 yr.	6.9 yr.	4.0 hr.	17%
Professional	15.1 yr.	7.6 yr.	2.8 hr.	15%
Craftsman	11.8 yr.	10.6 yr.	3.3 hr.	18%
Operator	11.6 yr.	4.6 yr.	4.3 hr.	15%
Handler	10.5 yr.	2.9 yr.	3.9 hr.	15%

1. Operators and handlers have the least formal education, the largest turnover rate, and the greatest amount of daily exposure to hazardous substances.

2. Craftsmen have greater job longevity than other categories, may not have achieved a high school diploma, have a moderate amount of daily exposure to H/M but have as great a need for additional competency as do operators with less education and greater daily exposure.

3. Persons who contact H/M daily are exposed approximately one-half their productive work day.

4. While educational levels and average time on the job (experience) are variable, there is no significant difference in the overall need for improvement. However, these needs may differ.

5. Those with the least amount of time on the job are less likely to recognize a need for improvement in competency, although their exposure may be as great or greater.

6. There is no relationship between formal educational achievement, length of time on the job, amount of daily exposure and the need for improvement.

Comparison of Employer/Employee Responses. The following tables compare frequency distribution rather than averages and include only those employees who considered the questions as being applicable to them.

Table 17 compares employer responses to employee responses, using the Chi-squared test. As indicated by the Chi-square of less than 5.99, there are no significant differences between the way all employers and employees, who felt the questions applied to them, responded.

TABLE 17

EMPLOYER/EMPLOYEE RESPONSES
ALL SUBJECT AREAS

	Employer (observed)	Employee (observed)	Total (observed)
Above Average	131	154	285
Adequate	357	511	868
Needs Improvement	143	241	384
Total	631	906	1,537

Tables 18 and 19 compare subject areas within the two groups and show essentially the same results, as would be expected, since there are no significant differences between the two groups as shown by Table 17. The differences are in two areas, health and recognition. The responses in these two areas differ significantly from all of the other areas.

SUMMARY OF SURVEY FINDINGS

TABLE 18

EMPLOYERS

	Above Average	Adequate	Needs Improvement	Total
Recognition	26	66	48	140
Handling, Storage & Disposal	40	84	28	152
Health	15	50	39	104
Transportation	28	76	18	122
Emergency Information	22	81	10	113
Total	131	357	143	631

TABLE 19

EMPLOYEES

	Above Average	Adequate	Needs Improvement	Total
Recognition	45	112	73	230
Handling, Storage & Disposal	30	128	47	205
Health	19	75	48	142
Transportation	32	106	41	179
Emergency Information	28	90	32	150
Total	154	511	241	906

These differences can be shown more graphically by coding the responses as 1, 2 or 3 (1 = above average, etc.) and calculating an average response for each subject area. Such a coding results in the following comparison:

	Employers	Employees
Recognition	2.16	2.12
Handling, Storage & Disposal	1.92	2.07
Health	2.23	2.21
Transportation	1.92	2.07
Emergency Information	1.89	2.03

Also of interest, when examined in this way, is the fact that employers consistently rated their employees higher than the employees rated themselves except in the areas of Recognition and Health. As shown earlier, these differences are not statistically significant within our sample but should be noted.

Needed Training. There is a need to develop training programs to adequately instruct people who daily contact hazardous substances. This need is demonstrated through the evaluation of employee capability as shown in the competencies ratings assessment by employers and by employees.

Training needs for specific industries may vary widely because of 1) industrial processes and materials used, and 2) the existing training capability of the industry (including that provided through suppliers). Therefore, it is helpful in planning delivery strategy to know something about the size of the companies using hazardous substances in terms of numbers of their employees. One could assume a skills assessment needs of employees would differ considerably among small firms as opposed to large industrial operations, as would the amount and type of exposure to hazardous substances. Another variable would be the responsibilities of supervisory personnel in large operations as opposed to those of nonsupervisory personnel. In smaller operations this distinction is likely to be considerably lessened.

The following table shows the number of firms estimated to use hazardous materials and the number estimated to generate hazardous waste by company size:

TABLE 20

ESTIMATED NUMBER AND % OF FIRMS USING SPECIAL SUBSTANCES AND GENERATING SPECIAL WASTES BY SIZE

No. of Employees	No. Using	% Using	No. Generating	% Generating
1 - 20	1,489	73.7	1,210	71.9
21 - 50	223	11.0	195	11.6
51 - 100	115	5.7	91	5.4
101 - 250	110	5.4	105	6.2
251 - 500	45	2.2	45	2.7
501 - 1,000	16	.8	15	.9
Over 1,000	23	1.1	23	1.4
Totals	2,021	100%	1,684	100%

The above table shows that 90% of the firms who use special or hazardous substances in their operations in Iowa have fewer than 100 employees; and 85% of the firms have fewer than 50 employees. Of firms who generate special wastes, 89% have fewer than 100 employees and 83% have fewer than 50 employees. One could assume these small firms have less in-house training capability than do large firms, while the employee exposure would be as great or greater since employees in small operations tend to perform more functions. Clearly, any training strategy must consider training needs of the small firms without in-house training capability, as well as those of large operations with more technologically advanced facilities and resources.

Who Should be Trained? Survey results provide little evidence to indicate a difference in training needs of entry level personnel as opposed to up-grading for existing positions. Rather there seems to be a difference in individuals' awareness of their own need for additional training. Reasons for this are inconclusive. It may be due in part to the inability of some employees to recognize familiar material as having hazardous characteristics. It is interesting, as noted earlier, that individuals who have been with their company for 4 to 7 years tend to indicate a need for improvement more often than new employees or those who have been there for longer periods of time. Large companies recognize a need for training more than do small firms; however, employees of large companies do not indicate a need for improvement as often as do employees in small firms. The study showed no significant difference between supervisory and less than supervisory personnel in their recognition of a need to improve.

If we accept the assumption that employees who possess fundamental understanding of substances encountered in the course of daily work will be a company asset, then the need for training of personnel at all levels becomes obvious. The study clearly demonstrates that a great many employees who daily encounter hazardous substances recognize they do not possess sufficient understanding.

If we also accept the assumption that there is a direct correlation between informed employees and costs in man-hours and materials, the need for training at all levels becomes even more obvious.

What Should be Taught? More than half of all employers in the survey indicated their employees needed to improve their competency level in the areas of occupational health; handling, storage and disposal of hazardous substances; recognition and use; and/or in the transportation of such materials. Employees agreed with their employers on this finding.

In order to accommodate the wide variances between industries and their processes and the raw materials currently contributing to the hazardous waste stream, training programs should be developed around substances common to many industries. This approach would accommodate diverse industries - both large and small - by recognizing a common bond similar to training for specific job functions. Substances contributing to the hazardous materials stream in Iowa should be identified and grouped harmoniously for module development.

Training plans should then be developed which describe the knowledge of skill topics to be taught and the method or methods by which the training will be given. These plans should address training for both supervisory and less than supervisory with clearly defined course objectives for each group. The life cycle of the substances from generation to proper disposal should be covered. Learners should be able to recognize potentially hazardous situations and to understand and interpret specific information pertinent to the substances. A typical module may have several submodules in order to address the entire life cycle of the substances being studied. A do and don't approach should be taken with practical problem-solving as a methodology.

How Should Training be Delivered? Training may be accomplished through a variety of methods or combinations of methods. Once modules with basic information have been developed, supplemental materials and techniques may be employed to adjust the level and scope of the presentations for supervisory or less than supervisory personnel.

Ideally in large plant operations, existing training programs may be utilized and the training offered at the plant site. During the interview process, employers continually indicated they would use training only if it were specific enough to their operation. The development of training plans for a specific plant should be directed not only toward the materials or substances involved, but through the use of supplemental material toward the industrial processes and technologies employed in the operations. "In-house" training may be provided by qualified employees using the basic modules. However, if this approach is used, training schedules should be developed and used, and instructors should be experienced in teaching and have received some assistance in selection and development of supplemental materials.

Special programs may be needed for small industries or consortiums of firms. The study shows that in sheer numbers there are more small firms who use special substances and generate special wastes than there are large firms. The study also shows more employees in small firms indicate a need for training than do those in large firms.

Training programs for these firms will probably have to be offered on community based college campuses throughout the State. Logistic problems may be more difficult to cope with since time and travel factors will be considered.

A training plan for a consortium of small firms will need to take into consideration, to the extent practical, the manufacturing processes and job requirements of the majority of those to be trained. Job categories will not be as clearly defined in small firms as in large companies. It should be possible, however, to develop a listing of tasks or job functions most generally performed in the daily contact of the hazardous materials or substances being encountered. Circumstances of the encounter will probably vary more often than those in large firms and should be considered in the development of supplemental materials. Flexibility of instructional materials and format as well as the abilities of the instructor to accommodate specific needs of trainees is crucial. For these reasons, the writers conclude training for smaller industries in Iowa can probably best be delivered through a community based college and should be developed around substances common to many industries as opposed to job skill training more commonly given.

Industrial Survey

The manpower section of this report points out that Iowa workers in manufacturing are among the most productive in this nation. This productive capability uses, produces and disposes of thousands of different kinds and types of raw materials and chemicals. Many of these materials are either hazardous in their own nature or become hazardous in association with other materials. Developing an effective strategy to solve the disposal problems generated by this productivity is a primary concern of the generating industries and of the State government.

There are an estimated two million recognized chemical compounds on the market today. Chemical sales now exceed $100 billion per year, with over 30,000 chemical substances in commerce. To these, a thousand new ones may be introduced each year.[5] While this study did not attempt to catalog by generic name all these substances used or produced in Iowa, it is clear that a tremendous volume of special wastes generated from this production are destined for land disposal.

The working definition for determining the waste to be identified by the study was:

---

[5] Toxic Substances Act, Environmental Protection Agency, Office of Toxic Substances, October 7, 1976. p. 1.

SUMMARY OF SURVEY FINDINGS

> "Special waste which requires special handling and which must be disposed of in such a manner as to protect the public health and conserve the environment."

Only in the last several years have the public health and environmental effects of improper waste disposal to the land come under serious study in the United States. This problem may be manifested in ground water contamination by leachate from landfills, surface water contamination from runoff, air pollution from open burning and evaporation, sublimation and wind erosion.[6]

In addition to planned disposal of waste products on the land, accidental spills of hazardous materials also contribute to the problem. From July 1, 1975, through June 30, 1976, there were seventy-five (75) spill incidents of hazardous substances reported to the Department of Environmental Quality in Iowa. The total volume of spilled material was approximately 188,000 gallons. Of this total, over 53,000 gallons were agricultural chemicals from 16 incidents, over 117,000 gallons were petroleum products from 41 incidents, and over 17,000 gallons of other substances from 18 incidents. The locations of these accidental spills were Statewide. The materials involved in these spills include gasoline, fuel oil, industrial solvents, acids, propane, anhydrous ammonia, chlorine, liquid fertilizers, and pesticides. Besides the reported volumes of spilled materials, it is safe to assume significant volumes remain unreported.[7]

In order to better understand the dimensions of the problem in Iowa, this study had as one of its purposes to survey the quantities, form, geographic distribution and current hazardous waste disposal practices of industries within certain SIC groupings. No effort was made to obtain technical information concerning the production, by-products of production, uses, or effects of the hazardous substances or chemicals. The study was not intended to serve as the basis for a risk assessment of the disposal practices of industry in Iowa; however, it can serve as an "early warning" of practices which might pose urgent risks to the health or the ecological resources of the people of Iowa. In the past, these practices have usually surfaced only as the result of accidents occurring with human or ecological victims. Near misses such as the incident in March 1977 involving thousands of gallons of a solvent containing the highly toxic substance polychlorenated biphenyl (PCB) thought to be destined for use in dust control on Iowa roads are dramatic evidence of the need to assess these risks and to develop a system for better management of waste materials.

The data displayed in this study represents the accumulative and subjective opinion of industry in Iowa. The 95% confidence intervals and the narrow ranges of those intervals suggests that these industries working independently reached essentially the same conclusions about the categorizations of their waste types and the life cycle involved in the treatment and disposal of them. Much remains to be done to clarify the extent of the risk involved in these practices. However, this study, perhaps because of the degree of randomness, is a valid "indicator" of the special waste problem in Iowa. Volume amounts recorded on tables would be biased low since commercial haulers, disposers and service industries were not included in the survey nor were public agencies and institutions.

---

[6] Environmental Protection Agency, John P. Lehman, Director, Office of Solid Waste Management, Federal Program for Hazardous Waste Management, 1976.

[7] Iowa Department of Environmental Quality, Background Information and Regulatory Needs for the Control of Oil and Hazardous Chemical Spills

Definitions to be used in categorization of waste types were developed by DEQ and are the same groupings used to identify special substances encountered by employees in the course of their daily employment, i.e., flammable, explosive, pathological, toxic, corrosive, reactive or unclassified. (See pages 13 and 14 for definitions) Data for explosive waste was later merged with that classified as reactive since few employers included in the survey had explosive waste to report.

Volumes, Locations and Types of Special Wastes

Data requirements for this study were intended to be quite broad. As is usual in any study, the intended use of the information determined the type and extent of data collected. The intended purpose of the study was (1) to provide DEQ with sufficient information about the life cycle of potentially hazardous wastes to allow the identification and prioritizing of necessary elements for a hazardous waste management plan; and (2) to provide opportunity for industry to have input into that planning process while, at the same time, preserving anonymity. Where appropriate, data already available to DEQ through the activities of its own Divisions was to supplement data acquired by the study.

During the study, concern was repeatedly voiced that considerable amounts of data related to the health and environmental acceptability of commercial chemicals had already been requested by various departments of State government and what was necessary was better coordination in "information gathering." However, it was generally agreed to by industry that proper disposal of hazardous wastes in Iowa was a difficult, complex and often times expensive problem; one that must be addressed by State government in terms of technology, economics and land acquisition.

The study estimates there are 573,907,000 kilograms of solid special wastes to be disposed of annually by Iowa industries. There is an estimated 132,156,000 liters of nonsolid hazardous waste to be disposed of annually by Iowa industries. If we accept the assumption that categorization of waste types by industry represents their best judgment of "problem prioritizing" of that waste's essential nature, a review of Tables 1 and 2 in Appendix C shows that industry in Iowa tends to identify its waste essentially as being either flammable, toxic or corrosive in nature or a combination of these types. The confidence intervals indicate these various types of waste, with the exception of corrosive solid wastes, are fairly evenly distributed among reporting industries. Variances by geographic area are displayed on the following table.

TABLE 21

VOLUME OF WASTE IN EACH AREA SCHOOL QUADRANT BY TYPE*

ANNUALIZED VOLUME	Liters & Kilograms	(in 1,000s of units) QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)	STATE TOTAL
Flammable	L	1,151 (1,105-1,497)	774 (320-1,591)	17,215 (2,474-63,541)	2,998 (2,473-5,434)	22,138 (6,372-67,525)
	K	122 (86-159)	53 (48-63)	617 (594-638)	75,135 (75,071-75,202)	75,927 (75,850-76,007)
Pathological	L	**	**	**		**
	K	**	**	178 (93-422)	143 (10-276)	483 (190-777)
Toxic	L	6,013 (5,931-6,260)	33 (22-44)	1,747 (1,614-5,126)	2,634 (2,461-2,832)	10,427 (10,028-13,575)
	K	1,613 (1,422-1,925)	457 (79-1,025)	310 (253-367)	1,715 (1,559-1,922)	4,095 (3,526-4,664)
Corrosive	L	57,044 (57,024-57,132)	1,007 (995-2,963)	917 (317-1,954)	14,822 (14,400-16,439)	73,790 (72,736-76,011)
	K	**	**	**	463,074 (454,123-1,601,958)	463,832 (454,482-1,602,318)
Reactive	L	**	**	**	**	**
	K	**			**	**
Unclassified	L	**	**	**	**	3,046 (2,543-4,238)
	K	**	**	**	13,975 (8,896-23,811)	29,133 (23,748-38,749)

* The 95% confidence interval is shown in parenthesis below the estimate.

** Five sample firms or fewer reporting.

An examination of this table shows the wide variance in the corrosive solid waste occurred in Quadrant IV. This is caused by one firm in SIC 28 generating a substantial amount of a mildly corrosive waste. This again points out the randomness of the subjective thought process. It is significant however that rather than not report the waste at all, the company did report the volume recognizing the mildly corrosive nature of the substance but noting it did not fully meet the pH requirements of the definition since it was solid and not nonsolid in form. If the volume amount reported by this firm is removed from the tables, the confidence interval for solid corrosive waste in Quadrant IV would be similar in range to those of the other quadrants.

It should be noted the confidence intervals of the volume data displayed on Table 21 remains consistent in the evenness of the spreads thus suggesting that within these smaller units, industry tended to make similar decisions regarding the character of their waste and that these random decisions are reflected in the close variances for the Statewide totals. The low volumes reported for Quadrant II may be a reflection of the fewer number of large metropolitan areas in northwest Iowa as opposed to the number in other quadrants.

While Tables 1 and 2 in Appendix C show significant differences in total volume amounts of waste generated by industry between SIC groupings, the data indicates there is no single major source of hazardous waste generation but rather multiple streams of generation across Iowa. The significantly larger volumes of waste as categorized by industry between SIC groupings may be the result of industrial processes and technology employed by reporting firms. For example, there is a significantly larger volume of flammable solid waste estimated for firms in SIC group 33 than for other SIC groups and a similarly larger volume of nonsolid flammable waste for SIC 28 than for other major SIC groupings. The estimate for SIC 33 is affected by a major firm disposing of large amounts of industrial solid waste they identified as being flammable in nature while the nonsolid flammable waste is affected by a size A (1 to 20 employees) firm generating a large amount of a sludge waste from the use of a highly flammable, explosive and reactive material. The waste collection and treatment system of the major industry producing solid flammable waste is very different from the small firm producing the flammable sludge waste. The disposal problems associated with these volume figures would likewise be different but can be expected to be associated with the treatment processes employed. The risks associated with the disposal of the large volume of size A firm generation may be greater than that volume generated by the larger firm. The study did not gather the data necessary to make this type of judgment; however, it is clear that the generation of multiple waste streams by small firms cannot be ignored in a State management plan.

In order to make the data relating to volume amounts more meaningful, it should be viewed in perspective to the number of firms estimated to be generating special wastes. The study estimated the locations of generating firms as follows: Quadrant I, 371; Quadrant II, 319; Quadrant III, 357; and Quadrant IV, 637. The following table displays these estimates by SIC major groups.

TABLE 22

ESTIMATED TOTAL NUMBER OF FIRMS GENERATING HAZARDOUS WASTE CLASSIFIED BY MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Estimated number of firms generating hazardous waste*
07	351 (252-450)
22,29,31,32,37	13 (11-15)
24	36 (8-64)
26	21 (15-27)
27	609 (519-699)
28	236 (176-296)
30	18 (11-25)
33	32 (25-39)
34,39	269 (208-330)
35	66 (51-81)
36	33 (22-44)
Total	1,684 (1,516-1,850)

* The 95% confidence interval is shown in parenthesis below the estimate.

The total number of generating firms is undoubtedly low since the number estimated to use hazardous or special substances is much higher (2,021) than the number estimated to generate special wastes (1,684). (See Table 3, Appendix C). Some of this difference could be attributable to the technology employed in waste collection systems and the operational efficiency of in-plant waste control pollutant abatement methods. This would be particularly true of some firms using primarily flammable materials who indicated they had no special wastes since residues simply evaporated. Of the firms reporting, 36.8% reported generating two or more types of waste and one firm reported the generation of two or more types of waste 25% of the time, while firms with more than 100 employees reported two or more types of special waste 58% of the time.

Treatment, Transportation and Disposal of Wastes

An analysis of treatment and disposal method for handling of special wastes can be categorized by four general forms of waste:

- liquid
- sludge
- solid
- gas

Such a distinction is helpful in tracing and understanding the general disposal practices of industry in Iowa. For purposes of this study, solid waste quantities are reported in kilograms and nonsolid waste quantities are reported in liters. An estimated 1,299 firms in Iowa generate solid special wastes and an estimated 962 firms generate nonsolid waste.

While technical means exist to safely handle all hazardous wastes,[8] no controls exist in Iowa to ensure that essential technical treatment takes place. Disposal controls do not provide a means to identify all potentially hazardous materials nor the means to control their safe disposal. Companies may dispose of hazardous wastes on their own property without permit or they may contract with an outside carrier to dispose of their wastes without real knowledge of its final disposition. Wastes are shipped out-of-state by contract for recycling or for disposal. They may or may not be treated prior to disposal.

The following table displays methods of transportation, treatment and disposal for volumes of the four waste forms.

[8] A Study of Hazardous Waste Materials, Hazardous Effects and Disposal Methods, Volume I, Booz-Allen Applied Research, Inc., July, 1973, pp. V-3.

TABLE 23

ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED* BY IOWA FIRMS CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT AND DISPOSAL

	Estimated volume of hazardous waste***			
Method of Handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company	2,533 (1,642-4,194)	1,483 (1,352-3,778)	462,458 (460,377-1,607,922)	** **
By outside contract	24,394 (23,651-25,655)	19,387 (3,689-64,812)	111,111 (101,355-127,830)	
Treatment at plant site				
Chemical	93,859 (86,005-133,890)	28 (27-28)	244 (82-969)	
Incineration		** **	268 (72-811)	
Solidification		** **	1,185 (1,175-1,422)	
Neutralization	10,455 (9,375-12,335)	1,132 (790-2,774)	498 (84-912)	
Other	611 (539-851)	** **	4,894 (2,447-15,192	
None	6,135 (5,309-9,357)	19,728 (4,243-65,381)	566,809 (553,744-1,701,561)	** **
Disposal methods				
Sewer	69,329 (68,793-72,201)	** **	** **	
Company site landfill	39 (34-62)	289 (224-484)	456,981 (455,605-1,603,143)	
Municipal landfill	349 (159-858)	2,850 (2,274-5,437)	4,468 (3,327-6,251)	
Out-of-state	442 (338-847)	201 (140-437)	75,151 (74,989-75,876)	
Recycle/Reuse				
By company	960 (694-1,540)		17 (7-32)	
By outside contract	14,461 (14,391-14,606)	** **	2,968 (2,719-3,416)	
Other	23,244 (15,332-63,220)	** **	3,396 (3,059-5,035)	** **
Unknown	2,235 (1,845-4,504)	17,516 (2,391-63,485)	30,916 (17,887-44,319)	

---

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.
*** The 95% confidence interval is shown in parenthesis below the estimate.

SUMMARY OF SURVEY FINDINGS

A quick examination of the preceding table indicates generators are most apt to provide disposal at a company site for solid waste and to contract out disposal of liquid and sludge wastes. The most obvious reasons for this would probably lie in the cost/effectiveness of maintaining the company site for solid waste disposal as opposed to the increased costs associated with the transportation and handling problems as well as the site restrictions associated with liquid and sludge disposal. It is more cost/effective for companies to contract out for the disposal of its more difficult wastes.

Solid Waste. Disposal of solid wastes on company property does not guarantee the engineering benefits of county landfill operations; however, solid waste represents a less immediate environmental threat to the land than do liquids or sludges. In addition costs of gate fees assessed at county landfills can be eliminated if disposal is at a company owned site and if environmental concerns can be guaranteed.

By far, the greatest volume of solid waste receives no treatment prior to its disposal which may reflect on the feasibility of treatment for some of these wastes. Wastes extracted from the water treatment and air collection systems are included as solid waste. As restrictions imposed to control wastewater treatment and air pollution discharge tighten even more, the processing and disposal of hazardous solid wastes to the land could, in terms of sheer volume, become Iowa's largest management problem.

Shipment out of state for disposition of special solid wastes is second in terms of total volume. Due to costs involved in long range interstate shipment, this can probably be attributed to the hesitancy of county landfills to accept certain substances and, to a lesser degree, weather restrictions imposed at some landfill sites. The economics of waste disposal will ultimately be the determining factor of the amounts and types of waste that will be moved to distant disposal sites. Industry generally will not ship wastes that can be satisfactorily and more economically treated at the point of origin. Iowa does not have approved disposal sites for some types of hazardous wastes.

Liquid Waste. As noted above, industry in Iowa tends to utilize outside contractors for disposal of nonsolid wastes.

Since chemical treatment is more easily performed on liquid wastes than on other waste forms, some type of chemical treatment or neutralization was generally indicated. It is important to note, however, that industry officials most often reported neutralization was accomplished through dilution by water. A significant amount of liquid waste is disposed of by sewering. This must be looked at in relationship to the volume of waste chemically treated and probably results in most cases after filtration of non-sewerable material. A significant amount of liquid special waste however is estimated to be discharged to the sewer without any treatment. The practical limiting factor in treatment is the costs which must be incurred to achieve total decontamination.

Sludge Waste. The difficult nature of sludge wastes and the disposal problems associated with them is shown by the large volume transported by outside carrier, without treatment, to an unknown destination or to a municipal landfill. The safest and environmentally most acceptable way to dispose of dewatered stabilized sludge is to landfill it in a well operated sanitary landfill. However, stabilized sludge requires treatment; raw sludge cannot be disposed of legally at a sanitary landfill until after it has been stabilized. Heavy metals content dictates whether or not the sludge is hazardous. Industry in Iowa most often finds the solutions to problems and site restrictions associated with the disposal of its sludge wastes (defined as hazardous) to be more cost/effective when handled by outside contractors than when processed by the company. Liability for site disposal and method is transferred to the contract carrier; however, some industries utilize contract carriers for disposal of part of their wastes and dispose of the balance at a company site or a sanitary landfill. In some cases, wastes are stored indefinitely.

Contract Carriers. The variety of waste streams in Iowa generated by the use of or production of hazardous substances becomes even more difficult when the volumes of waste handled by outside contractors is recognized. Once introduced into the waste stream through use of a contract carrier, it is difficult to control and monitor the content or disposition of the waste. The generators of a single product may use materials or processes that create hazardous conditions when their wastes are added to those of other firms. As the variety of wastes being transported by a single carrier increases, the probability of creating hazardous waste effects through mixing also increases. Such intermingled waste streams are no longer the treatment responsibility of the generator but, as a practical matter, are the treatment responsibility of no one since carriers are essentially a part of the transportation industry and can be expected to have little knowledge or capability in this area. As noted earlier, transporters were not included in the SIC major groups selected for this study. This deficiency is a major limitation of the study.

Contract operators reclaim an estimated 14,461,000 liters of nonsolid waste and an estimated 2,968,000 kilograms of solid waste generated in Iowa each year. In addition, it may be assumed that a portion of the 643,000 liters and 75,151,000 kilograms estimated for out-of-state shipment each year are eventually recycled; although estimates cannot be made on the amounts. "The transportation of hazardous materials within and through Iowa constitutes a significant threat to the State. It is apparent that minor incidents occur frequently within Iowa as a result of human and equipment failures. The nature of the products involved in these accidents leads to the conclusion that a hazardous situation exists."[9]

Major Employers vs. Minor Employers

One of the areas of interest for the study was to determine the collective practices of waste disposal of major companies as opposed to small sized companies who presumably had less technical capability for treatment of their wastes. Firms with fewer than 100 employees are estimated to generate 23,352,000 liters of nonsolid special wastes and an estimated 4,791,000 kilograms of solid waste annually. The following table compares the generation volumes for small firms with those of larger firms.

---

[9] Hazardous Analysis, A Research Assessment, Iowa Disaster Preparedness Program. Iowa Civil Defense Division, 1976. p. 62.

TABLE 24

ESTIMATED VOLUME OF HAZARDOUS WASTES GENERATED BY IOWA FIRMS CLASSIFIED BY SIZE OF COMPANY AND PERCENT OF TOTALS

	Firms With 100 or Less Employees	Firms With More Than 100 Employees	Total
Number of Firms	1,496	188	1,684
Percent of Total	89%	11%	100%
Kilograms of Solid Waste	4,791	569,116	573,907
Percent of Solid Waste	1%	99%	100%
Liters of Nonsolid Waste	21,352	110,804	132,156
Percent of Nonsolid Waste	17%	83%	100%

Tables 4 and 5 in Appendix C show methods of transportation, treatment and disposal of waste for firms with more than 100 employees and for firms with 100 or less employees.

Major differences in practices are:

1) Small companies tend to transport their own liquid wastes while large companies contract for this service.

2) Small companies tend to contract with outside carriers for solid waste disposal while large companies transport the largest volume of their solid waste to the company site most probably to reduce hauling and disposal costs.

3) Both small and large companies contract for disposal of the largest volume of their sludge wastes.

4) Small companies have very little capability for treatment of their own wastes other than dilution by water. The greatest volume of their liquid waste is disposed of by sewering.

5) The estimated total volume of liquid waste disposed of at an unknown location is nearly equal between small and large companies.

6) Small companies have greater capability for treating their own solid wastes than for treating their nonsolid wastes. The confidence intervals shown on the tables indicate no single favored method of treatment among small firms although the largest volume amount remains untreated.

7) The most surprising finding of this comparison is the actual volume of sludge waste generated by firms with 100 or less employees is estimated to be greater than the collective volume estimated to be generated by firms with more than 100 employees. This sludge waste receives no treatment and is generally destined for an unknown disposal site. The greater volume of sludge waste from smaller firms is probably due to the more sophisticated and efficient treatment available to major companies enabling them to convert the sludge to a solid state before disposal. Additionally, if the sludge results from a washdown operation, small companies are apt to generate proportionally greater volumes of sludge since their washdowns are generally more inefficient. This is a particularly important finding in assessing priorities for a State management plan considering the particularly difficult problems associated with sludge disposal and the possible effects from mixing of wastes by contract carriers. The wide variance shown in the confidence intervals for the estimated volume of sludge waste transported by outside contractors in firms with 100 or fewer employees is the result of the A size firm reported earlier as having a large amount of waste from the use of a highly flammable, explosive and reactive material. This seems to suggest there are a few major and multiple small generators of sludge waste among small size employers.

8) Major companies dispose of their sludge waste in a variety of manners. The largest volume is estimated to go to municipal or county landfills. The table indicates this is with the company's knowledge; it either being transported by the company or by an outside contractor.

Appendix C also contains similar information on Tables 6 through 11 for the classification of waste types, i.e., flammable, pathological, toxic, corrosive, reactive and unclassified. Cells with five or fewer than five sample firms reporting have been asterisked. There are no confidence intervals established for these subtables and no comments will be made regarding them.

Storage of Wastes

The Environmental Protection Agency must, within 18 months of passage of Resource Conservation and Recovery Act of 1976[10] (April 1, 1979), define from a legal and regulatory point of view what constitutes hazardous waste. They must also define what constitutes a harmful quantity, and set up by regulation, criteria for a permit program. Twenty-four months from passage of the act a permit will be required for the treatment, storage and disposal of all hazardous wastes.

---

[10] Title III, Section 301

SUMMARY OF SURVEY FINDINGS

Clearly this will require a plan for management of hazardous wastes in the State from the point of generation through the transport phase, to storage, treatment and/or recycling, to the final disposal of residues.

The extent to which hazardous wastes are stored or not stored in Iowa and the extent to which waste can adequately be stored will determine the priority placed on storage in the development of an overall management plan. The extent to which the waste is concentrated or nonconcentrated and the hazards associated with either the high or low concentration is a problem which must be addressed as well as the availability of adequate treatment facilities and process economics elsewhere. The economics of transporting the waste for ultimate disposal will also play a key note in determining whether or not a company will store particularly difficult wastes. This study did not seek to determine the adequacy of storage methods used by industry in Iowa. Its primary purpose was to estimate the number of firms who either store special waste or do not store wastes for over 24 hours. Where storage occurs, the study sought to estimate the number of firms who stored more or less than 1,000 kilograms of solid waste indoors, the number who stored more or less than 1,000 kilograms of solids outdoors, the number who stored more or less than 500 liters of nonsolid wastes indoors, and the number who stored more or less than 500 liters of nonsolids outdoors. No effort was made to determine actual volumes, the concentration of the materials or the precise content. Industry was asked to categorize the stored waste by type and indicate, where appropriate, the type of labeling applied.

An estimated 1,310 Iowa firms or 78% of those who generate special wastes store their wastes for periods longer than 24 hours. The survey estimates that approximately 492 firms generating at least one type of solid waste store the waste indoors; and an estimated 712 firms generating at least one type of solid waste, store waste outdoors.

Of the firms generating solid waste, 38% provide indoor storage and 55% provide outdoor storage. Of those storing, only 5% store more than 1,000 kilograms when stored indoors for more than 24 hours and only 8% store more than 1,000 kilograms when it is stored outside for more than 24 hours. Of those generating solid waste 62% do not store solid waste indoors and 26% do not store solid waste outdoors.

Of the firms generating nonsolid waste, 48% provide indoor storage and 17% provide outdoor storage. Of those storing nonsolid waste, only 12% store more than 500 liters for more than 24 hours when stored indoors and 83% store more than 500 liters when stored outdoors for more than 24 hours. Of those generating nonsolid waste, 52% do not store indoors and 83% do not store nonsolids outdoors.

The following tables display the estimated number of firms generating nonsolid and solid special wastes by storage of waste at plant site, amount of waste stored over 24 hours and type of waste.

TABLE 25

ESTIMATED NUMBER OF FIRMS GENERATING NONSOLID WASTE CLASSIFIED BY PLACE OF STORAGE OF WASTE AT PLANT SITE, AMOUNT OF WASTE STORED OVER 24 HOURS, AND TYPE OF WASTE

	All	Type of Nonsolid Waste					
Storage*	Types	Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified
Total number of firms generating nonsolid waste	962	420	**	508	197	**	45
Indoor storage at plant site							
Stores nonsolid waste indoors	461	227		244	47		26
500 liters or less	373	170		217	37		**
More than 500 liters	88	57		27	10		**
No indoor storage	501	193	**	264	150	**	19
Outdoor storage at plant site							
Stores nonsolid waste outdoors	160	109	**	32	29		13
500 liters or less	28	18		10	**		
More than 500 liters	132	91	**	22	**		13
No outdoor storage	802	311	**	476	168	**	32

---

* Storage of nonsolid waste at the plant site over 24 hours.

** Five sample firms or fewer reporting.

TABLE 26

ESTIMATED NUMBER OF FIRMS GENERATING SOLID WASTE CLASSIFIED BY PLACE OF STORAGE OF WASTE AT PLANT SITE, AMOUNT OF WASTE STORED OVER 24 HOURS, AND TYPE OF WASTE

Storage*	All Types	Type of Solid Waste					
		Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified
Total number of firms generating solid waste	1,299	630	258	597	34	**	52
Indoor storage at plant site							
Stores solid waste indoors	492	225	93	183	**	**	17
1,000 kilograms or less	466	216	93	**	**	**	**
More than 1,000 kilograms	26	9		**	**	**	**
No indoor storage	807	405	165	414	**	**	35
Outdoor storage at plant site							
Stores solid waste outdoors	712	295	79	319	25	**	46
1,000 kilograms or less	458	239	**	223	**	**	11
More than 1,000 kilograms	254	56	**	96	**	**	35
No outdoor storage	587	335	179	278	9	**	6

* Storage of solid waste at the plant site over 24 hours.

** Five sample firms or fewer reporting.

SUMMARY OF SURVEY FINDINGS

An examination of these tables indicates that more firms store flammable and toxic wastes than any other type, but industry does not store its wastes for more than 24 hours when immediate disposal methods are available. Solid wastes are most apt to be stored outdoors while nonsolids are most often stored indoors. When nonsolids are stored outdoors for longer than 24 hours, it is generally in amounts of more than 500 liters.

The following table displays the geographic spread of firms storing waste by type most frequently stored. A higher percentage of firms in Quadrant III store wastes than in the other areas.

TABLE 27

ESTIMATED NUMBER OF FIRMS BY QUADRANT WHO STORE HAZARDOUS WASTE

	Quadrants				
	I	II	III	IV	Total
Number of Firms Generating Waste	371	319	357	637	1,684
Number of Firms Storing Waste	274	225	317	494	1,310
Percent of Firms Storing	74%	71%	89%	78%	78%
Predominant Type Stored	Flammable	Flammable	Toxic	Toxic/ Flammable	

Tables 12 through 23 in Appendix C provide estimates on the number of firms who store waste by type and by geographic area. Storage of the flammable and toxic wastes is fairly evenly divided between geographic areas with less toxic waste being stored in Quadrant II than in the other areas. Storage of corrosive and unclassified wastes is more concentrated in Quadrant IV, although these wastes are stored in the other areas as well.

Additional information would be necessary in order to plan for adequate storage and to determine the risks to the immediate environment from present storage facilities.

Appendix C contains subtables of storage and labeling practices in each area school quadrant by type of substance. Because of the asterisk procedure, no comments will be made regarding them.

Labeling of Wastes

A label is the simplest most immediate method of communicating to adults the presence of a hazard. There are a number of labeling systems in widespread use for identifying hazards associated with products offered for sale and in the transportation of them. For example, the Department of Transportation has approved labels which must be attached to each package of hazardous materials offered for shipment unless exempted from labeling requirements. (Title 49, CFR, Sec 173.404(a)). These are based on the United Nations' labeling system authorized for domestic and foreign shipments. They are not dependent upon the ability to read; and, because they do not require reading of the other hazard information which might be present on the label, provide an instant visual alert. Specific symbols are recommended for materials which are extremely toxic. highly toxic, corrosive, flammable, pyroforic, or strong oxidizers.[11]

The extent to which industry in Iowa utilizes these or similar labels to communicate the hazards that may be associated with its stored waste products was of interest in this study. The interest was assumed since stored wastes are associated with the work places of employees and stored wastes generally retain their mobility and may be transported in the future for recycle/reuse or disposal by the company or by an outside contractor. In either event, the presence of hazardous substances as a waste product presents as great a hazard to humans, (even though the severity of the hazard will vary), as do hazardous substances used or created in production processes or offered for shipment. Products are required by law to be labeled by the manufacturer and the shipper. Waste materials are not covered by uniform labeling regulations until shipped.

Industry officials were asked to indicate if stored wastes were labeled as to: warning of hazard, ingredients, emergency procedures, other, or no label for each type of waste they stored for more than 24 hours.

There are an estimated 1,310 firms in Iowa who store waste for longer than 24 hours; this is 78% of the firms estimated to generate special wastes.

The following table displays the labeling practices of these firms:

---

[11] Recommendations of the Standards Advisory Committee on Hazardous Materials Labeling, Extracted from the Committee Report, Occupational Safety & Health Reporter, 1976. p. 109.

TABLE 28

ESTIMATED NUMBER OF FIRMS STORING WASTE USING DIFFERENT TYPES OF LABELING CLASSIFIED BY TYPE OF WASTE

Type of Waste	Number of firms generating waste	Number of firms storing waste*	Type of Labeling Used: Warning of Hazard	Ingredients	Emergency Procedures	Other	None
Flammable	854	711	142	291	16	**	402
Pathological	261	175		**		**	174
Toxic	978	721	122	196	52	**	452
Corrosive	221	102	29	44	24	**	74
Reactive	27	13	**	**			**
Unclassified	93	89	**	25	**		69
Total No. Firms	1,684	1,310					

** Five sample firms or fewer reporting.

* Sums for types of labeling may exceed the number of firms who store since a single firm may use more than one kind of label within a single type or have more than one form of waste of a single type.

The above table shows that the majority of firms who store special wastes do not provide any type of labeling on the container. Percentage of firms who do not label their wastes by type of waste is as follows: flammable, 66%; pathological, 99%; toxic, 63%; corrosive, 73%; and reactive, 78%.

The opportunity for accidents from lack of knowledge, mishandling, and/or misunderstanding is graphically displayed in these figures.

Appendix C contains further estimates of firms who store waste and their labeling practices by type of waste. Because of the asterisk procedure, no comments will be made regarding them.

Summary of Findings by Major Group SIC Classifications

Major differences in the amounts of special waste generation by Iowa industry are most significant when analyzed by classifications of reporting industries. As previously noted, there will also be variances among industries within each SIC grouping caused primarily by the size of firms and the treatment technology and disposal methods available as well as the industrial processes employed in the production of various products.

A summary description of the study findings for firms within each major group studied follows.

SIC 07 - Agricultural Services. The agricultural services classification is a broad classification but generally refers to veterinarians, livestock sales and farm service operations such as landscaping, farm management, and breeding cooperatives. Although industries in this classification are mainly service oriented, their close association with agri-chemicals and supplies was considered significant cause for including them in the survey. This group has 5% of the employees but more significant is that 21% of all firms who generate hazardous wastes in Iowa are in this major group. This is understandable not only by the fact that Iowa remains an agricultural state but also by the broad nature of businesses enveloped in this SIC.

Most businesses within the 07 class contact both toxic and/or pathological substances. Of the firms contacted, 58% indicated, however, that they did not generate hazardous waste from the use of the materials.

The industries in this major group included in the survey fall mainly into two classifications: a) veterinarians, and b) farm services. This accounts for the large number of firms generating pathological wastes in this group as well as the large number of professionals who daily contact hazardous substances. It was interesting that veterinarians in Quadrants I, II and IV tended to classify themselves most often as professionals, while veterinarians in Quadrant III generally classified themselves as administrators.

The type and amount of training given to subprofessionals is job specific depending primarily on the needs of the individual operation. For instance, veterinarians operating small-animal clinics have specific needs in the areas of administering shots, assisting with surgeries and post mortems, processing cultures, and taking blood samples; but more general operations providing services for livestock owners, have very limited needs in these areas. Presently this training is strictly on-the-job and job specific. Several veterinarians indicated a need for formally trained assistants. Others felt strongly about the need for educating farmers and farm workers in the hazards of agri-chemicals. One veterinarian interviewed described three separate accidents in his immediate area involving agri-chemicals. One resulted in livestock losses, one in ground and water contamination, and one nearly resulted in the loss of life.

Waste materials from this classification fall into the pathological and toxic categories from such materials as diseased carcasses, culture swabs and plates, used syringes, blood samples, dressings, empty pesticide, herbicide and insecticide containers and empty or outdated vaccine bottles.

The amount of waste and disposal methods are highly variable within the SIC depending on the type of business. For the most part wastes (90% in firms surveyed) are untreated before disposal. The municipal landfill received 19% of the waste of surveyed firms. Wastes generated at farm locations are left for the farmer to dispose of, although at least some of these wastes were reportedly disposed of in public trash containers.

In the past, toxic and pathological waste from veterinary operations were frequently incinerated prior to disposal. Recent burning ordinances have restricted such treatment; however, among the firms surveyed, 9% of the waste was still being incinerated. This included cultures, dressings, diseased carcasses, vaccine containers and insecticide, pesticide, spray and other disposable containers. In this group 64% of reported waste was diseased carcasses or surgical wastes transported by outside contractors destined for "other" disposal (generally rendering companies). Some 14% of the firms indicated they did not know the final disposal site. Several firms indicated culture materials were routinely rinsed with alcohol prior to disposal.

Farm service operations and individual custom applicators who apply large volumes of agri-chemicals generally leave the empty containers (paper sacks, plastic and metal cans) with the farmer for disposal. One custom applicator indicated he recycled the containers after they were flushed as scrap metal.

The shift from city dumps to county landfills has apparently created some disposal problems for at least one type of material--diseased elm trees. Tree trimming and removal businesses reported that they have been severely restricted by some landfill operators as to the volume and time of day and week for disposal of diseased trees. According to one individual interviewed, this practice has resulted in private individuals using county roads and private property to dispose of the material illegally.

The estimated waste generated by this SIC group was 426,000 kilograms. This is only .07% of the Statewide total. This is significant when it is noted the small volumes of waste are generated by 21% of the generators of special wastes in the State.

SIC 24 - Lumber and Wood Products, Except Furniture. Industries surveyed within the "Lumber and Wood Products" classification used a very limited variety of hazardous materials in their manufacturing processes. Types of industries include rehabilitation workshops for the physically and mentally handicapped, wooden pallet manufacturers, and industries making a variety of household products such as kitchen cabinets, wicker basket and hampers, wooden doors and windows and wooden trim.

The amount of hazardous materials used and disposed of depends primarily on the size of the industry. Material types generally are limited to flammable paints and solvents.

SUMMARY OF SURVEY FINDINGS

Those firms involved with rehabilitation and training work for the handicapped reported using paint, thinners and stains but because of the varying abilities of the workers any training in handling the materials is very limited. Such operations rely on constant and close supervision rather than extensive training. Employers in this area did not feel training programs in handling and disposal of hazardous materials would be of particular benefit.

The firms manufacturing wooden pallets indicated they did not use hazardous materials. After speaking at length with employers in this area, interviewers concluded this was accurate since such operations simply construct wooden pallets to order specifications.

The remaining industries in the classification generally reported large volumes of paints, thinners, varnishes, lacquers, adhesives, and paint strippers. Other materials being used were toluene, tolusol, xylene, all highly flammable and explosive under certain conditions.

Training is on-the-job and limited to persons applying or mixing materials. Training is "by example" and consists of having a new man watch and assist an experienced painter for a period of time until he becomes familiar with the operation. Although interested in development of training for employees, most firms were more interested in solving problems associated with waste disposal.

Waste materials for this SIC group fall into both the flammable and toxic categories and include such things as spray booth filters, dry over-spray, paint splattered floor and wall coverings, paint sludges, solvents, empty containers with residue, and contaminated paint strippers. Paint sludges represent the biggest disposal problems due to the large volumes involved and restrictions on disposal. As a result some industries were disposing of sludges on their own property.

One employer indicated increased costs and restrictions imposed by sanitary landfills had forced him to dispose of sludges on his own property or close down his operation. Under the imposed restrictions he could dispose of 165 gallons of paint sludge per day just prior to closing time at the landfill. Because of shift changes within his operation at that time of day, it required one hour of overtime for one employee per day plus transportation costs to utilize the landfill. Although dissatisfied with the situation, he felt there was no other alternative.

Treatment of materials prior to disposal is limited to soaking paint spray filters in water for 24 hours to reduce their flammability. Generally 55 gallon paint and thinner drums are recycled by returning them to the supplier. One and five gallon cans usually are disposed of as solid waste. Wastes are generally transported to disposal by outside contractors. A large amount is being stored outdoors for pickup. A small amount of solvents is recycled through an outside contract.

The estimated waste generated by this SIC is 182,000 liters and 15,000 kilograms which is only .1% and .003% of the estimated State volume respectively.

SIC 26 - Paper and Allied Products. This group includes firms engaged in the production of corrugated cardboard or cardboard containers.

The potentially hazardous waste in this group comes primarily from processes related to printing and metal plating.

Flammable materials in use include acetone, toluene, propyl acetate, trichloroethylene, adhesives, ink, parafin wax, sodium sulfide, formaldehyde, isopropyl alcohol, isopropyl acetate, methyl ethyl ketones, nitropropanes, methyl cellosolve, gasoline, and liquefied petroleum. These flammable liquids may also be explosive; however, employers recognized them as flammable. The highly reactive octalene was also included as flammable.

This SIC grouping included toxic materials such as ink, nickel salts, iron chloride, copper sulfate, and other plate etchings as well as defoamer.

Corrosive substances in use include caustic soda, hydrochloric acid, muriatic acid, sodium sulfite, sodium carbonate, phosphoric acid, sulfuric acid and aluminum deep etch.

Of the firms surveyed in this major group, 47% indicated they did not generate any hazardous waste. One such firm indicated they used only biodegradable substances in their production.

Training programs are generally on-the-job by "example" from a supervisory or another experienced worker. Some industries do provide structured training in cooperation with their local fire departments. The departments periodically demonstrate fire fighting techniques using flammable materials common to the industries. However, several employees felt demonstrations did not emphasize sufficiently the importance of proper handling and disposal of flammables or in the use of protective clothing.

Waste materials are flammable, toxic, corrosive and unclassified. They generally include a mixture of contaminated substances in use. Caustic soda, however, is consumed in the process of making corrugated cardboard and has no waste other than the metal containers. These are generally returned to the supplier for reuse.

Of the firms surveyed 91% dilute corrosive liquids before sewering. Flammable sludge appears to present the greatest disposal problem. Surveyed firms reported 100% of this waste was disposed of out of state, some going for recycling. Also, 41% of all waste was contracted for recycling or reuse. Lubricating oils were reported as disposed of 58% of the time at the municipal sanitary landfill while 40% of these wastes were recycled.

The number of employees who handle hazardous substances in this SIC was just 3% of the State total of such employees and only 1% of the total firms generating hazardous waste were in this major group. The group generated 2,407,000 liters which is 2% of the State total and 3,066,000 kilograms which is .5% of the estimated State total.

SUMMARY OF SURVEY FINDINGS

SIC 27 - Printing, Publishing, and Allied Industries. Industries surveyed in SIC 27 include newspaper publishers, book binders, printers and custom printing shops. Modern technology has affected industries within this SIC more than probably any other industrial classification. The shift from linotype printing to offset operations greatly reduced the amount of hazardous materials used by printing shops. Only a small number of shops were found still using linotype printing.

Petroleum based inks are being replaced with water soluble inks greatly reducing or eliminating their flammability. Such inks still contain varying amounts of heavy metals and some cyanide. Because of the high cost of ink, however, waste from this material is kept to a minimum.

Other hazardous materials in common usage are press solvents, various types of caustic press washes, lubricating oils, acids and photographic chemicals. According to one employer, training in proper handling and disposal of such materials consists of showing a new man how to apply the solvents, how to wipe them off and where to place the dirty rags.

Although photographic equipment and chemicals do require some technical knowledge, none of the firms surveyed indicated they provided training. Persons working have received their training prior to their employment and are considered craftsmen, i.e., photographers, pressmen. Employers do, however, encourage employees to attend supplier seminars and training sessions where new products and techniques are discussed.

Hazardous materials in common usage in the SIC are flammable, toxic, corrosive and unclassified types. Much of the waste generated by this SIC falls into one of two categories: a) solvents, inks, acids and oils from press operations, or b) photographic chemicals from darkroom operations and from drip offset processes. They include photochemicals, empty containers with residue ink and solvents, and various amounts of nitric, phosphoric, acetic and sulfuric acids. Almost 25% of the firms in this SIC reported no waste.

It was found that 72% of liquid waste, consisting mainly of photochemicals, darkroom chemicals and various acids, were neutralized by dilution with water before sewering. The bulk of cleaning solvents are seldom disposed of directly by an industry since they are absorbed into cleaning rags which go to commercial laundries. In general all empty containers go to the sanitary landfills except 55 gallon drums which are returned to supplier for reuse.

By far the greatest amount of all solid waste is taken by outside contractors (78%), without treatment (76%), to municipal sanitary landfills or to an unknown destination. This is generally empty containers containing residue from ink, glue solvent, strippers, photochemicals as well as some paint, lacquer cans and filters. However, one firm indicated some phosphoric acid, without further treatment, was going to the landfill. The only waste being shipped out of State contained lead and tin. Of the firms surveyed 21% reported their solid waste was being recycled/reused by an outside contractor.

SUMMARY OF SURVEY FINDINGS

Sludge waste from this SIC group is made up of waste oil, ink, solvent and photochemicals. Of the firms surveyed who produced sludge waste, 99.5% was untreated and 98% went to the municipal sanitary landfill.

Only three firms surveyed reported they retained any photochemicals for recycling although one firm indicated the recovery of silver made it profitable to store the chemicals for later pickup. Most of these chemicals are diluted with water and sewered.

This major group employs 14% of employees estimated to daily handle hazardous substances in Iowa and 35% of all firms estimated to use hazardous substances. Even though a substantial percent of such firms (35%) is estimated to be in this major group, the estimated liters of waste were 406,000 which is only .3% of the State total and 91,000 kilograms of solid waste or .02% of the estimated State total.

SIC 28 - Chemicals and Allied Products. There are an estimated 236 plant sites in Iowa engaged in the manufacture of organic chemicals and the manufacture or formulation of pesticides (including allied products) who handle or dispose of special wastes. Each of these plant sites produces at least one and usually more commodities classified in SIC major group 28 and discharges process wastes from its production lines. There are additional firms beyond those surveyed in major group 28 who are in the explosives industries. Specific data was not gathered from those firms upon which to make estimates.

Industries within this classification have probably as broad a variety of manufacturing processes as any SIC included in the survey. The SIC includes among others paint manufacturers, grain processing plants, organic and inorganic chemical manufacturers, fertilizer blenders and manufacturers, and farmer cooperatives.

The type and amount of training given to employees is highly variable often depending on the type and size of the industry. Most of the large industries offer both structured and on-the-job training for new employees and for other employees requiring particular job skills. Small industries in general use some form of on-the-job training. Farm cooperatives generally provide certification training for their agri-chemical applicators.

Employers within this SIC tended to rate their employees' competencies higher than did employers in other SIC groupings. Interviewers felt this reflected true feelings about present training capabilities in many cases but in some cases also reflected an unwillingness to admit present weaknesses.

Hazardous materials used with this SIC include large amounts of every category except explosive and 30% of the sample firms said they did not generate any hazardous materials. The most common wastes with significant hazard potential include such things as paint sludge, waste solvent, spent acids, alkalies, nitrates, sulfides, lubricating and fuel oils, pesticides, empty containers (pesticides, herbicides, paint, pigment), and contaminated fertilizer. Pathological wastes included diseased animal carcasses and bacterial and virus cultures.

SUMMARY OF SURVEY FINDINGS

Although all these materials can and do present disposal problems at some locations, paint sludges and empty containers from pesticides, acids and like chemicals, present the most widespread problem. Transporting of wastes in this grouping is done primarily by the company. Almost 50 times as much is transported in this fashion than by an outside contract. As in other major groups only a small percentage is treated before disposal. The method for treatment most often used is neutralization which is the most favored method for pesticides. While some acids are also neutralized, a large amount of acids, solvents, strippers and paint sludges are not, the exception being those containing hydrocarbon solvents which in some cases are being recycled out-of-State. Much of the untreated wastes are deposited at company owned landfills, although only 11% of the sludge is disposed of at company sites while 39% is estimated to go to municipal landfills. Much of the pathological waste is chemically or otherwise treated before disposal although some is incinerated and some recycled.

Several industries reported storage of wastes on their own premises. Some are forced to transport chemical wastes out-of-State since no mutually agreeable method of disposal handling could be established between the generators, the landfill operator and DEQ. One company indicated storage of an outdated chemical for five years, not knowing how to dispose of it. DEQ has approved hazardous waste disposal techniques at specific landfills, but landfills are not required to accept such hazardous waste substances.

Most of the large corporate industries maintain their own wastewater treatment facilities capable of treating liquid wastes.

Farm cooperatives who distribute and apply large volumes of agri-chemicals are generally not faced with any direct disposal problems involving empty containers since containers are generally left at the farm site for ultimate disposal by the farmer. This further adds to the problems associated with multiple sources of small volumes of waste.

This SIC has the largest volume of waste estimating 41,962,000 liters which is 32% of the State total and 456,745,000 kilograms which is 80% of the State total.

We estimated 5,500 individuals or 23% of the total number who daily contact hazardous substances are employed by firms in this major group.

SIC 30 - Rubber and Miscellaneous Plastic Products. The industries surveyed in SIC 30 were manufacturers of rubber tires, inner tubes and a variety of fabricated rubber and plastic products such as gaskets, hoses, sponge rubber, extruded plastics and polyethylene.

Training programs, particularly in larger industries, consist of both on-the-job and classroom training and is generally safety oriented. Several employers indicated an interest in having training in safe handling of hazardous substances available.

Waste materials are flammable, toxic, corrosive and unclassified and include along with other chemical compounds such things as paints, paint thinners, hexane, rust strippers, numerous solvents, MEK, trichloroethylene, ammonium hydroxide, sodium hydroxide, sulfuric, hydrochloric, phosphoric and nitric acids, caustic baths, resins, rubber grade sulfur, zinc dibutyldithiocarbomate and stannous chloride. Of the firms surveyed, 39% indicated they did not generate any special wastes.

The hazardous waste generated in this group include paint sludges, empty paint containers, contaminated solvents, spent acids, asbestos fibers and end mold plastic. A relatively small amount of any of the waste was treated. On the whole firms surveyed in this classification relied on commercial contract haulers for disposal of waste and indicated they did not know how or where materials were being disposed of after leaving the plant. The most difficult of these waste are acid sludges containing fluorocarbons and methylene chloride.

This SIC generates a large volume of unclassified waste composed of sludge and solids generated from the use of approximately 25 different chemical substances. This waste is picked up untreated by contract carrier for an unknown disposal.

We estimate there are 18 firms generating special wastes in this major group. They employ an estimated 6% of Iowa workers daily contacting special substances and represent 1% of the firms. Of the estimated Statewide total volume, this group generated 988,000 liters or .7% and 156,000 kilograms or .02% of that total volume.

SIC 33 - Primary Metal Industries. Industries in SIC 33 include those involved in the manufacturing of gray iron castings, ferrous castings, forgings, aluminum sheet and foil, aluminum wire and aluminum castings. The amount and variety of hazardous materials used by primary metals industries varies. Within the study area, the major generator of hazardous waste is from nonferrous foundries. (Those industries involved with casting and forging ferrous metals use a very limited amount, if any, of hazardous material.) These materials include alcohols, degreasers, sodium hydroxide, chlorine, phosphoric and nitric acids, mineral acids, caustic cleaners, trichloroethylene, quenching oils, lubricating oils, paints and phenols as well as some brass, bronze, aluminum, iron and cyanide.

The type and amount of training available to employees within this SIC range from none to nearly continuous in one case. Training capabilities depend primarily on the size of the company. On-the-job training is highly variable as related to the hazardous substance. Small firms generally rely on experienced employees as trainers while larger firms have one individual or whole departments responsible for safety and training.

Waste materials are flammable, toxic, corrosive and unclassified. Some 30% of the firms generating waste in this SIC indicated they did not produce any hazardous waste. These were generally establishments engaged in ferrous castings. Much of the reported special waste was of a solid nature which included empty containers with residue, (paint strippers and acids) phenols and a large amount of core and silica sand as well as dust from pollution control systems.

SUMMARY OF SURVEY FINDINGS

Several firms in this SIC had been or were presently working on wastewater treatment facilities capable of treating acids and spillovers or washovers. Internal plant recycling is practiced whenever possible, but most recycling is done by outside contractors and is generally solvents or other liquids. Some light oils are recycled. One firm after first chemically treating the acid and alkali waste contracted to ship the material out of State. Another firm disposed of liquid waste by sewering without treatment. This firm refused to estimate the amount of the waste.

In general there was a greater reluctance from firms in this SIC than in other groups to give information concerning the volume of waste generated, how it was treated and their disposal practices.

Disposal methods are quite varied. Sludge from paint, degreasers and oil generally is disposed of at the municipal landfills although some is picked up by outside contractors for disposal. Solids also are generally sent to municipal landfills except core sands which are frequently disposed of on private property. By far the largest volume of waste in this major group is transported for disposal by outside contractors; therefore, the firms could not say with certainty the disposal site.

The largest percentage of waste generated by this SIC was the core and silica sand, and dust from pollution control devices. Contaminants in this sand of concern are the phenol acids as well as other material which are commonly mixed for disposal. Because DEQ has not taken a position on the hazardous nature of waste sand, these volumes are reported as unclassified waste. This type also includes filters.

Several large firms in this major group indicated there had been major changes in technology within the industry in the last five years. Environmental and safety regulations were the major reasons cited. Because of these changes, industry officials felt there was substantially less hazardous waste being generated today by the industry than in prior years.

For SIC major group 33, the total estimated waste generated is 14,562,000 liters or 11% of the State total; and 109,985,000 kilograms which is 19% of the State total.

We estimate 36 firms in this major group who employ 2,259 individuals who daily contact special substances.

SIC 34 - Fabricated Metal Products, Except Ordnance, Machinery and Transportation Equipment. This major group includes establishments engaged in fabricating ferrous and nonferrous metal products. Industrial processes used by such manufacturers include stamping, forging, plating and painting.

Industrial sizes range from two and three man operations to well over 1,000 employees and the type and amount of training is proportionate to the size. In medium to large size industries, training is more job specific and more frequently directed toward job safety. The specific job requirements determine the type and amount of training given rather than general plant operations.

For example, one plant may be doing both plating and painting, or several other different operations, in the production of a single product. However, employees are trained only in the skills required for their specific duties. Some employers cited rapid turnover rates for employees with certain jobs as a reason for their very limited training programs.

Due to the wide variety of products and processes, SIC 34 produces a wide variety of hazardous wastes. Wastes include paint and oil, plastics, epoxy, as well as inorganic acids, alkalies, metal and cyanides; e.g., sodium cyanide, caustic soda, hydrochloric acid, sulfuric acid, nitric acid, chromates and magnesium as well as plating solution wastes.

Of the firms contacted, 28% stated they produced no hazardous waste. The remaining firms studied showed that 20% generated liquid waste, 14% sludge and 50% solid waste containing hazardous elements.

Disposal methods for these industries generally follow this pattern. Of liquid waste, 82% was disposed of through the municipal sanitary sewer system, and 82% of the liquid waste was reported neutralized by dilution or other processes. This is not necessarily the same 82% being sewered. The wastes discharged may be acid or alkaline depending on the types of baths which predominate and may contain toxic contaminations such as cyanides, chromates, copper, zinc nickel and cadmium. Other pollutants include alkaline cleaners, grease and oil, organic solvents and wetting agents. Waste produced in metal finishing operations come mainly from two sources: the dumping of process tanks and from rinse waters used to wash off process solutions.

Of the sludge waste, 88% was transported for disposal to a municipal (or county) sanitary landfill. Some 28% of all sludge in this major group was untreated prior to disposal. Of the untreated sludge 59% was sent to the municipal (or county) landfill while 16% went to a company-site landfill, and another 24% disposed of by a private contractor in a manner unknown to the generator. Sludges are formed in the treatment process and probably contain metal oxides which make them particularly troublesome in treatment and disposal.

The other form of waste generated by SIC 34 industries is solid waste, of which 76% is either recycled or reused by an outside contractor. This waste consists of paint and chemical containers and spillover as well as filters, metal shavings and floor sweepings.

Paint waste is generated by 57% of the firms in this SIC. This represents the greatest disposal problem in terms of volume of any materials within the SIC. Some of the paint sludges are recycled but some firms are forced to store them for lack of adequate disposal facilities. Some stated they did not know how they ultimately will handle the disposal of these wastes.

Of the surveyed firms some 29% generate inorganic acids which are mostly neutralized with water and sewered. Few of the industries have the capability to treat their liquid wastes. One firm had recently invested $250,000,000 for a new treatment plant for its own use. A very small percentage of the firms chemically treat their wastes.

One industry had designed and developed an inexpensive yet effective means of recycling stoddard solvent and waste oil. In an average year they could reclaim 5,000 gallons of stoddard solvent and nearly 20,000 gallons of oil. The system could reclaim nearly 5,000 gallons of waste oil per year on-site with 15,000 gallons being transported out of state for additional treatment. The stoddard solvent was reclaimed entirely on-site.

Of the surveyed firms, 61% of firms store the waste they generate. Some is stored indoors, some outdoors, and some of it for long periods of time. Over 80% of the firms have contracts with outside contractors for the transportation of the waste they generate. Most of the 55 gallon paint and thinner drums are either returned to the supplier for reuse, used around the plant or sold to the general public. Small containers are generally disposed of with the solid waste.

The total estimated waste for this SIC group is 8,781,000 liters and 1,910,000 kilograms which is 7% and 3% of the State total.

We estimate that 268 firms in this major group generate special wastes. This is 16% of the total number generating in the State. These firms employ an estimated 4,939 individuals who daily contact special substances or 21% of all individuals in the State estimated to daily handle these substances.

SIC 35 - Machinery, Except Electrical. The SIC group 35 titled "Machinery, except electrical" uses a wide variety of manufacturing processes similar to those used by industries in the SIC 34. However, unlike SIC group 34, industries in SIC 35 are on the average larger and less numerous within the State.

Hazardous materials fall into all categories except explosive and pathological and included such things as paints, thinners, solvents, sulfuric acid, chromic acid, nitric acid, hydrochloric acid, sodium cyanide and trichloroethylene. As in most other industries types, training in using these materials is limited to on-the-job with some classroom instruction at larger industries. Some firms have professional laboratory chemists or technicians handling materials who are responsible for design and testing and who are highly qualified by education. Training is usually given by an experienced worker or a supervisor. In the case of structured programs, instruction may be given by a plant safety officer.

Industries interviewed on-site within the SIC 35 gave very strong indications of a need for additional training in the area of handling hazardous substances. Employers stressed a do and don't approach rather than a technical approach. Many felt the technical approach would present too much material or create undue alarm among employees. However, such training must be more than simply saying "Don't put your hand in that." As stated by one employer, "We do that now and I don't consider it training."

By far the greatest volume of hazardous waste was generated by painting operations. Some 70% of the firms in this SIC generated special waste through paint sludges, spray booth filters, empty containers and the like. Also in this group, some 24% of survey firms dispose of spent acids. For the most part acids are sewered with no additional treatment. Some of the large industries have wastewater treatment facilities capable of treating liquid waste but most do not.

Hazardous waste material in the form of sludges and solids are infrequently treated and are generally disposed of by commercial haulers. Two other methods for the disposal of sludges and solids are: company owned landfills and municipal sanitary landfill facilities. Several employers admittedly did not know where the materials were ultimately disposed of; others were storing waste at the plant site until such time as adequate disposal methods and locations could be identified.

Within this SIC there seemed to be more expressed interest in hazardous waste and disposal problems than in some of the other groups. Several industries were actively seeking markets for recyclable wastes while others were seeking alternative disposal methods. One employer related the construction of a new addition to his plant. It had been designed and constructed without drains to prevent employees from unknowingly sewering hazardous materials.

The total estimated waste for this SIC group is 3,560,000 liters and 335,000 kilograms. This is 3% and .05% of the State total.

We estimate there are 67 firms in this major group who use hazardous substances. They employ an estimated 2,635 individuals who daily contact special substances. This is 11% of the total work force daily handling such substances.

SIC 36 - Electrical Machinery, Equipment and Supplies. Firms in this major group are engaged in manufacturing switches, switchboards, electric motors, home appliances, printed circuit boards and electric storage batteries.

As with other industries, the amount of training an employee receives depends primarily on requirements of his specific job. Some of the manufacturing processes are highly mechanized and controlled by computers, e.g., printed circuit boards. Other processes, such as manufacturing storage batteries, require a great deal of hand labor. In general, training related to hazardous material is provided on-the-job and is job and function specific. Structured or formal information about a particular material being used is generally provided by suppliers and is presented to the owners or supervisors who in turn instruct line employees.

Of on-site interviews with employers in this SIC, only one indicated any real interest in additional training programs. Several employers' first impressions were that they did not use any hazardous materials. Further questioning showed this was generally not the case, although of the firms contacted in this SIC, 16% indicated they do not generate any hazardous wastes.

Hazardous materials used are flammable, toxic, corrosive, pathological, reactive and unclassified types. Firms in this major group generate the greatest volume of corrosive wastes of any of the major groups included in the study. The major portion is acids which are chemically treated or neutralized by dilution before being sewered. A small percentage of the volume produced by surveyed firms is recycled by the company or through a outside contract. Only a small amount is shipped out of State. Other wastes generated by firms in this SIC include waste from caustic and cyanide solutions, lubricating oils, paints, epoxy, plastics, solvents, thinners, plating and etching solutions, empty containers, and various forms of lead. Paint wastes are generally small compared to other groups and do not present any widespread disposal problem. Lubricating oils and containers are often disposed of in sanitary landfills, given to employees, used in the plant, returned to the supplier or sold to the public. Molten lead and solder is generally solidified and returned to a supplier for reuse or is reused on location. In general, most solid waste other than lead waste is transported without treatment by outside contractors to municipal landfills.

Flammable liquids, mostly solvents, ketones and thinners, as well as flammable and toxic sludge wastes are also predominantly being disposed of through outside contracts but generally for recycling. Most of solvent and oil wastes are sent out of state without treatment for recycling, being stored outdoors until pick up. This major group also reported flammable gas wastes. The quantity of reactive waste generated is too small to be estimated.

The content of waste designated as unclassified by surveyed firms contained strippers, dye, oil, plastic, and a good amount of solder as well as mixed shop wastes.

The estimated waste generated by the firms studied in this SIC is 57,451,000 liters or 43% of the Statewide total. The estimated total waste in kilograms is 1,173,000 which is only .2% of the State total.

We estimate there are 33 firms in this major group who generate special wastes and who employ an estimated 1,595 individuals who daily contact special substances. This is 7% of the total in the State who daily contact special substances.

COLLECTION AND REVIEW OF MATERIALS

During February and March, 1976, GSAI collected and reviewed Federal and Iowa legislation and regulations, as well as selected legislative proposals, to assist the Department of Environmental Quality in developing a statewide hazardous waste management system.

In addition, national studies identifying hazardous waste materials and their storage, processing, transportation, and disposal were collected and reviewed to determine whether their conclusions might be applicable to Iowa's problems.

All States, Territories, Trusteeships and the District of Columbia were polled to determine what laws, regulations and studies have been published and/or are available.

A questionnaire was developed for use in personal interviews with Iowa State agency officials. (See Appendix A) The purpose of the interviews was to provide data on the nature and implementation methods of the administrative and legal powers assigned to the various Iowa agencies, their relationship with the legislature, gaps in the law and the ability of the agencies to respond rapidly and effectively in emergencies.

Review of Legislation/Regulations Applicable to Hazardous Waste

RECOMMENDATION OF U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA's 1974 Report to Congress: Disposal of Hazardous Waste, mandated by Section 212 of the Resource Recovery Act of 1970 (P.L.-512), is based on five comprehensive studies whose conclusions may be generally stated as follows:

The problem is larger than anticipated, and current disposal practices are inadequate.[12]

Technology is available for treatment of most hazardous waste.[13]

Most citizens would approve of regional processing facilities.[14]

---

[12] Booz-Allen Applied Research, Inc. A study of hazardous waste materials, hazardous effects, and disposal methods. [Bethesda, MD] June 30, 1972. 3v.

[13] Ottinger Recommended methods of reduction, neutralization, recovery, or disposal of hazardous waste, v1. [Redondo Beach, Calif.] TRW Systems Group, Inc. June, 1973.

[14] Lackey, L.L., S. R. Steward, and T.O. Jacobs. Public attitudes toward hazardous waste disposal facilities. [Columbus, Ga.] Human Resources Research Organization, Feb. 1973.

Processing off-site is preferable for most hazardous waste streams.[15]

A national disposal site is feasible.[16]

Land-based hazardous waste treatment, storage and disposal activities are virtually unregulated by Federal and State laws. EPA's chief recommendation is a control strategy in which the Federal Government would set process and performance standards, with State Governments responsible for administering and enforcing them.[17] This is essentially the conclusion of the Battelle Study, though the latter also recommends private ownership of processing, storage and disposal facilities.[18]

Existing Federal Legislation

Most U. S. Government statutes are summarized in the Report to Congress (Section 3: "The Case for Hazardous Waste Regulations," pp. 15-17). Congress has added new laws on Safe Drinking Water, Resource Conservation and Toxic Substances. The statutes may be briefly stated as follows:

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 requires registration and proper labeling.

Resource Recovery Act of 1972, Section 212 authorizes EPA to study the feasibility of national disposal sites.

Atomic Energy Act of 1954, as amended, authorizes the Atomic Energy Commission to regulate handling, transportation and disposal of radioactive wastes.

Transportation of Explosives Act of 1971 regulates transportation of explosives in interstate commerce.

---

[15] Funkhouser, J.F. Alternatives to the management of hazardous wastes at national disposal sites. [Cambridge, Mass.] Arthur D. Little, Inc., May, 1973. 2v.

[16] Battelle Memorial Institute. Program for the management of hazardous wastes. Environmental Protection Agency. 68-01-0762 (Richland, Washington) July, 1973. 2v.

[17] Office of Solid Waste Management Programs. Report to Congress; disposal of hazardous wastes. Environmental Protection Publication SW-115. Washington U.S. Government Printing Office, 1974. 110 p. p. 17.

[18] Ibid.

COLLECTION AND REVIEW OF MATERIALS

Hazardous Materials Transportation Act of 1970 evaluates hazards, establishes an accident-reporting system, recommends transport controls.

Safety Regulation of Civil Aeronautics Act of 1958 establishes security and safety standards for air commerce.

Hazardous Cargo Act of 1971 regulates packing, labeling, containers, certification.

Federal Hazardous Substances Labeling Act of 1960 authorizes identity of hazardous substances; prohibits transport unless certain requirements are met, and requires seizure of misbranded substances.

Federal Environmental Pesticide Control Act of 1972 regulates disposal and storage of pesticides.

Marine Protection, Research, and Sanctuaries Act of 1972 grants permits for ocean dumping; prohibits dumping of high-level radioactive wastes.

Clean Air Act of 1970 controls hazardous air pollutants.

Federal Water Pollution Control Act of 1972 (P.L. 92-500) controls discharge of pollutants into water.

Poison Prevention Packaging Act of 1970 establishes special packaging standards.

Food, Drug and Cosmetic Act of 1968 prohibits adulteration and misbranding of certain items; authorizes seizure and disposal.

National Environmental Protection Act of 1969 requires Federal agencies to prepare environmental impact statements.

Armed Forces Appropriation Authorization Acts of 1969 and 1970 regulates lethal chemical and biological warfare agents.

Coastal Zone Management Act of 1972 requires applicants for Federal Coastal Zone management grants to regulate hazardous waste disposal.

Occupational Safety and Health Act of 1970 sets standards for safety and health of persons engaged in interstate commerce.

Safe Drinking Water Act of 1974, (P.L. 93-523), provides for a regulatory program to protect underground drinking water sources.

Organized Crime Control Act of 1970 requires storage of explosives not controlled by a State or Federal agency.

COLLECTION AND REVIEW OF MATERIALS

Hazardous Materials Transportation Act of 1975 (PL93-633) regulates shippers of hazardous materials and manufacturers of containers used in commerce of these materials.

Resource Conservation and Recovery Act of 1976 provides technical and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials and for the safe disposal of discarded materials, and to regulate the management of hazardous waste.

Toxic Substances Control Act of 1976 (PL94-469) to regulate commerce and protect human health and the environment by requiring testing and necessary use restrictions on certain chemical substances, and for other purposes.

State Governments. Regulating land disposal is an area of relatively new emphasis. Most States now regulate transportation and disposal of solid wastes with little or no provision for treatment of hazardous wastes. EPA recommends comprehensive legislation, with the States having authority to: 1) identify hazardous waste, designating both quantity and concentration; 2) require all haulers and all generators to report their hazardous wastes - in some states, only haulers "for hire" are regulated; 3) require detoxification before disposal; 4) limit disposal sites to one or a few.[19]

Iowa. Sources for this portion of the report were Iowa Departmental Rules, 1973, the Code of Iowa, 1975, and written communications from agency officials.

The State of Iowa has no hazardous waste management plan. The existing regulation is through combined efforts of various Federal and State agencies.

Several Iowa State agencies have authority related to some aspect of hazardous waste management, either through direct regulation or through consultation and assistance. Other agencies have no specific jurisdiction in these matters, but their duties are nonetheless involved with hazardous waste. No State agency is specifically responsible for the entire sequence of stages in the life cycle of hazardous materials. As a result, both among the agencies and Statewide, there is a lack of definition, lack of knowledge about sources of hazardous waste, and lack of facilities.

A brief summary of the areas of responsibility of these agencies is given in Tables 29 and 30.

---

[19] Murray Newton "Hazardous Waste Management in the States"

TABLE 29

IOWA DEPARTMENTAL RULES, 1973
AND
CODE OF IOWA, 1975

Iowa State Agency	Code Chapter	Areas of Responsibility Related to Hazardous Waste Management: Labeling, Storage, Transportation, Disposal
Department of Environmental Quality	455B	Air and water quality; water treatment; sewage works construction; solid waste; radioactive waste; debris; agricultural chemicals.
Department of Transportation	307	Transportation policy, plans, safety.
Bureau of Labor	88	Occupational safety and health.
Department of Public Safety **a) Div. of Fire Protection & Investigation** **b) Div. of State Patrol Communications**	80 100, 101, 101A	Traffic safety on public highways. Flammable liquids, combustibles, explosives, liquefied petroleum gas.
Department of Agriculture	159, 163, 167, 170, 206, 207, 208	Inspection service; animal diseases; disposal of dead animals; hotels, food establishments; pesticides; paints and oils; petroleum products.
Natural Resources Council	84, 305, 455A	Oil and gas conservation (regulated by Natural Resources Council). Land use planning; environmental preservation. Oil and gas resources (administered through the state geologist). Water conservation; flood control; diversion of waters.
Commerce Commission	490	Pipelines; underground gas storage.
Department of Public Health	135	Public hygiene and sanitation; diseases and epidemics.
Soil Conservation Commission	83A, 467A, 467B	Mines. Soil conservation. Flood and erosion control.
Department of Public Defense - Office of Disaster Services	29C	Emergency planning, including man-made or natural disasters. Responsible for administration of emergency planning matters and coordination of responsible services in the event of disaster.

TABLE 30

REGULATIONS OF IOWA STATE DEPARTMENTS PERTAINING TO HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

According to Iowa Departmental Rules, 1973

	HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT				
IOWA STATE DEPARTMENTS	Labeling	Storage	Treatment	Collection/ Transportation	Disposal
AGRICULTURE	X	X	X[1]	X	X
BUREAU OF LABOR	X	X		X	X
COMMERCE COMMISSION		X			
ENVIRONMENTAL QUALITY	X[1]	X	X	X	X
HEALTH	[2]	[2]	X		
PUBLIC SAFETY		X		[2]	[2]
TRANSPORTATION	[2]			[2]	

1 - Department official said agency does not have authority in this area

2 - Department official said agency has authority in this area

COLLECTION AND REVIEW OF MATERIALS

Of the ten State agencies having some responsibility for hazardous waste management, five are central in that their authority is directed explicitly toward hazardous waste. These are the Departments of: a) Environmental Quality; b) Transportation; c) Agriculture; d) Public Safety, Division of Fire Protection & Investigation; and e) Bureau of Labor. Existing Iowa regulations are summarized in Appendix D.

In order to discover how the management of hazardous materials is regulated by law in Iowa, a review of State agencies was made. The study included:

1. A search of the index of Code of Iowa, 1975, a general subject index with chapter numbers, for any key terms relevant to hazardous materials, e.g., pesticides, pollution, waste, health, sanitation, explosive, etc.; and a review of all these references.
2. A review of all chapters describing the agencies thought most likely to have regulations.
3. A review of the Iowa Administrative Code, a compilation of all rules adopted by each agency.
4. An interview with officials of each agency (usually the directors) in which they answered 42 questions related to the administration of their statutes.

Data gathered from the Code of Iowa was presented to each official in a table showing areas of responsibility over the management of hazardous materials. The interviewee was asked to check the data for accuracy and completeness. The respective State agency responsibilities as corrected and/or approved by the respondents are summarized in Table 31 on pages 94 and 95.

In analyzing the nature of State agencies' authority, four types of administrative and legal powers assigned by statute were identified. They were:

1. Adjudicatory - having quasi-judicial powers, including the right to conduct hearings, make inspections, grant certification, or otherwise approve or make a judgment.
2. Advisory - having power to make recommendations, to conduct research, to give counsel, provide training.

   (Numbers 1 and 2 are closely related, their general nature being assisting and supportive.)

3. Regulatory - having power to make rules and set standards.

4. Enforcement - having power to ensure compliance through court action, imposing of fines, denial or revocation of permits.

(The chief characteristic of numbers 3 and 4 is to enjoin actions of others.)

Since the authority given to an agency may not always be direct, comprehensive or constantly applicable, the questionnaire distinguished between primary, meaning "having mainline authority under usual circumstance," or limited, meaning "under unusual circumstances."

The first section of the questionnaire was organized around the nature of the agency's authority and its extent. For each type, eight questions (seven in the case of advisory powers) relating specifically to some activity associated with hazardous waste were asked. However, since the purpose of the questions was to probe the officials' thinking about the nature and extent of agency powers, no effort was made to relate each question to every aspect of the life cycle of hazardous waste. Thus, for example, every possible aspect of labeling is not represented in the 31 questions.

To analyze the life cycles of hazardous material/hazardous waste, we defined these phases:

	No. of Questions
Labeling	2
Treatment	0
Storage	2
Transportation	2
Disposal	3
Emergency	4
Other	18

COLLECTION AND REVIEW OF MATERIALS

Prior to the interview, a chart depicting what we believed to be the agency's authority in the above named phases was developed. Representatives of the respective agencies approved the chart displayed on the next two pages as Table 31 as it depicts the following agencies' authority:

1) Department of Environmental Quality (DEQ)
2) Department of Transportation (DOT)
3) Bureau of Labor (BOL)
4) Commission of Commerce (COC)
5) Department of Soil Conservation (DSC)
6) Department of Agriculture (DOA)
7) Department of Public Safety (DPS)
    Division of Fire Protection and Investigation
    Division of State Patrol
8) Natural Resources Council (NRC)
9) Department of Public Health (DPH)
10) Office of Disaster Services (DS)

TABLE 31 PHASES OF THE LIFE CYCLE OF HAZARDOUS MATERIALS

AGENCY	CODE CHAPTER	LABELING	TREATMENT	STORAGE	TRANSPORTATION	DISPOSAL	EMERGENCY	OTHER
DEQ	455B C71,§406.5 C73,§455B.78		required before disposing at landfill -- treatment (water quality-discharge permits)	solid waste	solid waste	raw sewage, solid waste, hazardous waste, radioactive waste, explosive waste		proper use of pesticides
DOT	307 321 325 327 327A 327D	labels & containers for explosives while in transport -- labels & containers for hazardous materials			explosives -- hazardous materials		accident reports by carriers; hazardous materials	transportation on planning, policy & safety; permits, licensing
BOL	88 91	U.S. Department of Labor Occupational Safety & Health Standards, 29 C.F.R. 1910, 29 C.F.R. 1926 and 29 C.F.R. 1928 have been adopted by reference. Iowa rules complete OSHA Regs		OSHA Regs		prohibit open burning if it affects employees		
COC	490	underground gas storage		underground gas				supervision of pipelines
DSC						acid mine water		
DOA	167 205 206 207 208 200	trucks with carcasses, poisons, pesticides, register Fed. label, paints & oils, petroleum products, fertilizers (anhydrous ammonia)		sewage & liquid waste kerosene gasoline	animal carcasses, license shippers	animal carcasses	anhydrous ammonia, pesticides, poison in feeds	licensing of rendering plants-disposal plant; certification of applicators; inspection of transportation & storage facilities

DPS FM*	101 101A	flammables liquids combustibles explosives liquefied petroleum	(render harmless) explosives, neutralize deteriorated explosives	flammable liquids, combustibles, explosives, liquefied petroleum gas, explosive materials	flammable liquids, combustibles, explosives, liquefied petroleum gas, explosive materials	explosive materials	fires explosions	fire safety rules; investigation of fires
STATE PATROL	80 321						highway accidents & other emergency assistance	
NRC	455A	flood plains		flood plains		if potential pollution - obstruction flood flow		advice on environmental preservation -- water resources planning -- protection of water resources both underground & surfaces
DPH	135	CPSC-container poisons, drugs; FDA-drug itself not warehousing but health care cleaning disinfecting agents		at health care facilities				supervision of public health & sanitation
DS						after disaster remove debris if health hazard	planning, the development of emergency programs & coordination of services in event of disaster	

*anytime Federal DOT has jurisdiction (interstate), State fire marshall has no authority

COLLECTION AND REVIEW OF MATERIALS

At the present time, Iowa state agencies have the following regulatory responsibilities relative to hazardous waste:

The Department of Environmental Quality (DEQ), the principal state agency responsible for protecting the environment, has broad powers to prevent, control and abate environmental pollution. Purpose of its creation was to consolidate the existing programs of several state agencies and to coordinate environmental management. Within the Department is an Executive Committee and four policy making commissions: Air Quality, Water Quality, Solid Waste and Chemical Technology. The last two are the ones who will be most concerned with hazardous waste. The Solid Waste Disposal Commission regulates sanitary landfills.

The Chemical Technology Commission approves rules relating to pesticides and agri-chemicals promulgated by the Department of Agriculture; collects and analyzes pesticide episode information and develops rules for the transportation, storage and disposal of pesticide containers. It also restricts or prohibits the sale and use of agricultural chemicals, determines the proper use of pesticides, and enjoins the attorney general to institute legal action against their misuses and approves training materials, courses and certification of pesticide applicators.

The Solid Waste Disposal Commission regulates all aspects of sanitary land disposal projects which have been mandated since July 1, 1975. Dumping elsewhere is prohibited, except by businesses and industries on their own land. The 1976 Iowa Legislature refused passage of a bill which would have permitted DEQ to regulate the latter as well.

No sanitary landfill in Iowa can accept any industrial sludge, toxic or hazardous waste unless DEQ has approved the landfill for such materials.

Each commission in DEQ has two sections. The Surveillance and Compliance Sections are responsible for inspection and monitoring; the Permits Sections review and approve permit applications required for industrial air pollution control equipment, sanitary landfills and other solid waste disposal projects, and public water supply and wastewater treatment facilities.

DEQ feels it is the lead agency in the state in response to emergency spills. Its authority, however, is limited to advice and DEQ does not have primary investigative responsibility in emergencies. It does not have the authority to require that spills be reported nor does DEQ have the authority to require that spills be cleaned up.

Spills of hazardous or toxic materials have the potential of contaminating air, surface water, ground water or the land. While most companies report spills to DEQ and request technical advice from the agency, they are not required to follow the advice. Federal agencies which share authority to require cleanup frequently are so long delayed in taking action that environmental harm has been done. The Coast Guard and the Environmental Protection Agency have authority over spills if waterways are affected.

COLLECTION AND REVIEW OF MATERIALS

Department of Transportation (DOT). The Iowa Department of Transportation enforces regulations of the U.S. Department of Transportation. U.S. DOT regulations pertaining to the transportation of hazardous materials include requirements for preparation for transportation, e.g., construction of containers, packaging, weight or volume marking and other related factors.

Currently it regulates the following as hazardous classes: flammable and nonflammable; compressed gases; flammable liquids; flammable solids; oxidizer materials; organic peroxide; poison materials; etiologic agents; radioactive materials; corrosives and explosives. Thirty-eight of the 50 high volume chemicals are currently regulated as hazardous materials.

Bureau of Labor (BOL). The Iowa Bureau of Labor has adopted regulations conforming to the U.S. Department of Labor Occupational Safety and Health Standards 29 D.F.P. 1910 and 1926. (Chapters 10 and 26 of the Bureau of Labor Rules)

The Federal law (OSHA) controls hazardous materials in places of employment affecting interstate commerce. This portion on hazardous materials involves working conditions and exposure of workers to hazardous materials.

Department of Public Safety (DPS). Two divisions of DPS - Division of Fire Protection and Investigation, and the Division of Highway Patrol - have regulations relating to hazardous materials.

a. Division of Fire Protection and Investigation regulates the storage, transportation, handling and use of liquid petroleum gas, flammable liquids, combustibles and explosives. The National Fire Prevention Association's standards have been adopted by the state and are in effect.

This Division also requires notice of the storage of explosives, inspection of storage facilities by the county sheriff and regulation of their disposal by the Commissioner of Public Safety.

b. Division of Highway Patrol has authority to provide assistance in highway accidents and other emergency situations. Their duties are supportive and extend to crowd control, rerouting of traffic, regulating the orderly flow of vehicle traffic and responding to local law enforcement agencies' request for emergency assistance. By law, any carrier transporting hazardous materials must notify the Police Broadcast System or the local peace officer who in turn notifies the highway safety patrol.

Department of Agriculture (DOA). The Department is an administrative agency with authority to formulate policy, enforce policy and rules and it has preventive powers. "The single most important authority the Department has is the extent of the discretionary power it exercises. The essence of the departmental authority lies in determination of policy."[20]

---

[20] Iowa Department of Agriculture. Iowa Agri-Culture Serves the World: Biennial Report. July 1, 1973 to June 30, 1975. p. 100.

COLLECTION AND REVIEW OF MATERIALS

The Department is organized into three branches known as the regulatory division, the administrative division and the chemical laboratory division. All three divisions have some authority and involvement with hazardous substances and/or hazardous wastes.

It issues licenses to hotels, restaurants, and food establishments (including slaughterhouses - which are defined as food establishments "in which animals or poultry are killed or dressed for food") and regulates the removal of waste from their premises.

It has extensive authority over the use and disposal of dead animals; specifically it licenses and inspects the disposal site, and regulates disposal methods and the transportation of carcasses.

DOA was given the lead in developing the State Plan for Certification of pesticide applicators, and requires licenses of pesticide applicators, both commercial and private. Labeling of pesticide products is required and some pesticides are restricted as to use. Pesticide dealers must be licensed by the Department. Storage, transportation and disposal of pesticides are controlled by DOA. All rules of DOA pertaining to pesticides must be approved by the Chemical Technology Commission of the Department of Environmental Quality.

DOA also regulates the labeling and storage of paints, oils, kerosene and gasoline.

Natural Resources Council (NRC) is not responsible for any phase of hazardous waste or hazardous material as such, but is involved with any activity concerning disposal of wastewater underground. Underground storage or disposal of water or any material is permitted only when applicant provides proof that the requested diversion will not contaminate the aquifer utilized and is approved by DEQ (Water Quality Commission).

In addition NRC is charged with advice on environmental preservation, water resources planning and protection of underground and surface waters.

The Natural Resources Council regulates disposal of highly mineralized water and oil field wastes and supervises wells for the storage of dry natural gas and liquid petroleum gas. Since the Council has the authority to enforce a comprehensive program for the control, utilization and protection of the water resources of the State, and jurisdiction over flood control and the diversion of waters, it will presumably have some involvement with the establishment of any hazardous waste disposal site in Iowa.

State Commerce Commission. The Commission has authority to inspect and approve underground gas pipelines and storage facilities.

Department of Public Health (DPH). The division of health care facilities regulates public health, hygiene and sanitation. This includes storage and disposal of waste (including hazardous) from health care facilities.

DPH's authority is limited to the above and to requiring that drugs are labeled according to FDA requirements and containers of drugs be labeled to conform to Consumer Product Safety Commission requirements.

The Department of Soil Conservation (DSC), through the Division of Mines and Minerals, is concerned with hazardous materials only where it involves sediment and only when it contains acid wastewater from coal mines. It no longer regulates mine safety. This is entirely the responsibility of Federal Bureau of Mines. The Department's chief interest is in reclamation. It requires that the topsoil be kept free from contamination by acid or toxic material and that all coal mine wastes, acid forming or toxic materials be buried in approved pits.

The Department maintains a close working relationship with the Department of Agriculture, Natural Resources Council and Department of Environmental Quality. It cooperates with Federal agencies and gives permission for water impoundment structures.

Department of Public Defense, Office of Disaster Services. The chief role of the Office of Disaster Services (DS) is coordination. It has no statutory authority in hazardous waste management. It does have broad authority over emergency planning and program development for man-made and natural disasters, and includes responsibility for alert notification, public information, and resource coordination. Their duties consist of making plans, alerting the agencies who have expertise to deal with specific aspects of the emergency, e.g., DEQ, in the matter of hazardous materials disposal, and then reporting to the Governor and the Federal authorities. The office of Disaster Services is co-located with the Highway Patrol and has 24-hour emergency service.

DS does act in an advisory capacity in matters related to hazardous materials, offers first aid training which contains a section on hazardous materials, and seminars in the handling of anhydrous ammonia and agricultural chemicals. A recent publication, Hazardous Analysis Research Assessment (1976), indicates that the hazards which pose the greatest threat to the State of Iowa are: tornadoes, storms, droughts, earthquakes, flooding and the transportation of hazardous materials which is "currently not being monitored or supervised by a governmental agency." (pg. 62)

DS also publishes a Hazardous Substances Emergency Action Chart listing Federal, state and local agencies who can provide information or on-site assistance in transportation accidents involving 14 hazardous substances or situations.

Analysis of State Agency Interviews. Officials of 10 State agencies were interviewed between May 20 and June 21, 1976. Analysis of the interviews indicates that all interviewees were aware of their own agency's authority, rules and regulations pertaining to routine handling of hazardous materials. There was less understanding of the agency's role in emergency situations and little awareness as to which agency should take the lead role in given emergencies.

COLLECTION AND REVIEW OF MATERIALS

The Department of Transportation, the Bureau of Labor and the Department of Agriculture (Table 30) all have specific authority during certain emergency situations, e.g., accidents during the transporting of hazardous materials; fires and explosions; emergency situations relating to anhydrous ammonia, pesticides and poison in feeds.

During the interviews, questions relating to primary responsibilities in emergency situations were answered the same as in Table 30. However, to a question asking if agency staff actively investigated accidents and emergencies, the Department of Transportation answered "no" and the Department of Environmental Quality, the Department of Public Safety, the Natural Resources Council and the Commerce Commission answered "yes". Two follow-up questions, one asking if the agency had "primary" investigative authority, the other asking if the agency had "secondary" investigatory authority, indicated that primary authority was assumed by the Bureau of Labor, DPS and the Commerce Commission. Secondary investigatory authority was assumed by the Bureau of Labor, DPS, DOA and NRC.

Employees of each agency actively investigating accidents are trained in-house. In addition the Bureau of Labor contracts outside of government for some training, and all agencies except the Department of Public Safety provide employee training through other government agencies.

Many officials who were interviewed felt that other government agencies, both Federal and state, intruded in the handling of problems which should come under their domain. All ten believed that one or more Federal agencies either preempted, overlapped, duplicated or in some other way impacted on their own agency's administrative or operational activities. Only one half of the agencies felt other State agencies affected their roles in this manner.

State agency representatives "feel" that communication between State agencies is excellent. Most were looking forward to participating in the Inter-Agency Committee on Radiation, and most had staff members who participated in inter-agency technical committees established by various agencies and departments.

Every agency interviewed, with the exception of the Natural Resources Committee, thought their agency had an active role with the General Assembly in regard to legislation affecting hazardous materials.

Five of the ten agencies represented in the interviews stated their agency had presented legislation to the 66th General Assembly. Of these five, two knew the outcome of the legislation.

Legislation passed in the 66th General Assembly included:

1. Creation of an Interagency Coordinating Council on Radiation Safety. Members are DEQ, DPH, DOT, DOA, Office of Disaster Services, DPS, State Conservation Commission and BOL. Not included are NRC and Commerce, but these agencies were invited to attend all meetings.

COLLECTION AND REVIEW OF MATERIALS

Purpose of the legislation is to:

(1) Develop state radiation program plan
(2) Evaluate and coordinate radiation related activities
(3) Review radiation safety rules
(4) Collect and compile member agency's budget totals.

2. An act relating to the reporting of accidents which involve the transportation of hazardous materials to the state police broadcasting system or to the local peace officer.

3. An act creating an office of Disaster Services and joint county-municipal disaster services and emergency planning administrations, specifying the powers and duties of such offices, and adopting the interstate civil defense and disaster compact.

4. The enactment of the power plant siting law giving the Commission on Commerce the responsibility of approving plans to build power plants in Iowa. Rules and regulations will be forthcoming.

5. An act requiring commercial applicators of pesticides to furnish evidence of financial responsibility with the Secretary (Agriculture) prior to receiving a license. Financial responsibility may consist either of a surety bond or a liability insurance policy or a certification thereof.

6. An act relating to certification for applicators of restricted use of pesticides. Certification will be required effective October 21, 1977. The Secretary must adopt rules requirements for examination and certification, may adopt rules for training in cooperation with the co-operative extension service.

7. An act relating to the authority of the Department of Environmental Quality regarding water pollution control and public water supply systems.

8. An act transferring duties of the Energy Policy Council (to be abolished in 1979) to the Department of Transportation.

Other States. Sources of information for this part of the review were three:

1. published reports of 13 State agencies;

2. the Battelle report on 16 States;

3. EPA's report on 43 States.

COLLECTION AND REVIEW OF MATERIALS

Some of this data is overlapping. None was reported as available for: the District of Columbia, Hawaii, Louisiana, Oklahoma, Trust Territories, Virgin Island, Wisconsin.

The three sources are summarized as follows:

Reports by State Agencies. Letters from Garrity/Sandage Associates, Inc. (2/11/76) to 56 State regulatory agencies elicited 36 responses. Seven stated that no hazardous waste survey had been undertaken; 16 stated that a survey is planned or in progress (most of these will be published within a year); and 14 stated that a survey has been published, although two (American Samoa and Oklahoma) were not then available; three are surveys of metropolitan areas only (those of Wichita, Kansas and Atlanta, Georgia, are intended as interim reports; the Twin Cities survey will serve as a model for Minnesota's program); one (Maryland's) is preliminary.

The general purpose of the 13 available reports was to determine types, quantities, and disposal methods of industrial hazardous wastes. Most concluded that precise classification of hazardous waste is needed, and that special waste legislation should be drafted.

A brief summary of the major recommendations will suggest specific areas of concern.

STATE	SURVEY GROUP(S)	RECOMMENDATION
Arizona	Preliminary-476 industries; 142 completed. Final-500 industries; 75% completed (13 SIC groups)	Monitored sites
California	11 Class I disposal sites	Additional disposal sites; increased pre-processing of hazardous waste
Georgia (Atlanta)	8 waste haulers	Central treatment plant
Idaho	30 industries (19 SIC groups)	Comprehensive recycling; neutralization before disposal
Illinois	(This is a study, not a survey.)	State supervision; classification of hazardous waste
Kansas (Wichita)	33 pesticide applicators; 24 hospitals; 143 industries (16 SIC groups)	Further survey
Maryland	Questionnaire-3,449 industries; 1,549 completed. Interview-65 industries	Further survey

COLLECTION AND REVIEW OF MATERIALS

STATE	SURVEY GROUP(S)	RECOMMENDATION
Massachusetts	400 plus companies from 14 SIC groups	Comprehensive statewide management plan
Minnesota (Twin Cities)	45 SIC groups in 8 counties	Cooperative regulation-county, region, State
Mississippi	Questionnaire-2,146; 38% completed. Interview-336 industries (13 SIC groups)	Multi-county disposal sites
Oregon	110 industries (15 SIC groups)	Licensed disposal sites; classification of hazardous waste
Pennsylvania	(This report is a planning guide.)	One statewide plan; 11 regional plans
Washington	500 industries; 450 completed (11 SIC groups)	Comprehensive implementation

The Battelle Report. This study, Program for the Management of Hazardous Wastes, (July, 1973) reviews hazardous waste legislation in 16 States, selected for a balance in geographical distribution and proximity to sources of hazardous waste. The research emphasizes constraints that might delay implementation of hazardous waste programs. Topics include physical factors, safety requirements, land use, interagency cooperation, and status of Federal guidelines in each State surveyed. "Table 40" of the Battelle report summarizing the findings is reproduced on pages 94 and 95; those concerned particularly with the survey are briefly noted below.

States included in the report: Alabama, California, Colorado, Illinois, Kansas, Maine, Michigan, Nevada, New Jersey, New York, Oregon, South Carolina, Texas, Vermont, Virginia, and Washington.

DOT regulations have been adopted by every State except Michigan.

Six States have specific hazardous waste disposal sites.

Only Kansas regulates all aspects of explosives and pesticides handling--disposal, transportation, processing and storage.

Twelve States require licensing of solid waste disposal sites.

Five have adopted industrial safety regulations.

EPA Report. To obtain a view of the status of State programs related to land disposal, EPA's office of Solid Waste Management Programs asked the agencies (i.e., the Chief Officer of such Departments as Health, Sanitation, Environmental Quality, etc.) of 54 States to report their 1974 activities under six headings: land disposal of solid wastes; hazardous waste management; enforcement procedures; source reduction and resource recovery; public affairs; suggested Federal assistance. The first two are relevant to the present study.

1. Land Disposal of Solid Waste. Of 43 States responding to EPA's request, 19 have sites approved either for hazardous waste exclusively, or for all waste, with hazardous waste isolated at the same site; three (Mississippi, Missouri and Montana) are developing special sites; 21 have no disposal site for hazardous waste.

2. Hazardous Waste Management. Legislation in the majority of States is inadequate. The regulations in seven states require that disposal be approved; in 21 other states, hazardous waste control is implied or included in solid waste regulations, with pesticides and explosives the only materials specified; in this group of 21, four states regulate on a case-by-case basis. Maryland regulates only pathological wastes. Hazardous waste in Vermont seems to be entirely unregulated.

   Delaware, Florida and New Jersey require detoxification before disposal.

   California, Minnesota and Oregon have comprehensive legislation. Seven other states recognize the need for stricter laws, and have begun to draft them.

TABLE 40

SUMMARY OF STATE LEGISLATION SURVEY

	TRANSPORTATION		INDUSTRIAL SAFETY	PRESENCE OF EXISTING FACILITIES	
	DOT REGULATIONS	OTHER(a)	REGULATIONS FOR HANDLING HAZARDOUS MATERIALS	RADIOACTIVE	HAZARDOUS(b)
Alabama	YES	---	YES	YES	NO
California	YES	YES	YES	---	YES
Colorado	YES	NO	NO	NO	NO
Illinois	YES	YES	---	YES	NO
Kansas	YES	YES	---	YES	---
Maine	YES	---	YES	NO	NO
Michigan	NO	YES	YES	NO	YES
Nevada	YES	NO	NO	NO	NO
New Jersey	YES	---	DEV	YES	YES
New York	YES	---	YES	YES	YES
Oregon	YES	NO	NO	NO	NO
South Carolina	YES	YES	---	YES	DEV
Texas	YES	YES	---	YES	YES
Vermont	YES	---	DEV	NO	NO
Virginia	YES	---	DEV	NO	DEV
Washington	YES	NO	NO	YES	YES

(a) Includes hauling permits, vehicle registrations, material registrations, bills of lading, placard attachment, and vehicle standards.

(b) Includes pesticides, toxic substances, and other chemicals.

	EXPLOSIVES					LAND USE		
		REGULATIONS ON						
	DISPOSAL	TRANSPORTATION	PROCESSIN	[illegible]GE	SHORELINE REGULATION	CITY ZONING	COUNTY ZONING	STATE ZONING
Alabama	---	---	---	---	---	---	---	---
California	NO	YES	NO	YES	YES	YES	YES	NO
Colorado	NO	NO	NO	NO	NO	YES	YES	YES
Illinois	---	YES	---	---	YES	YES	YES	YES
Kansas	YES	YES	YES	YES	---	---	---	---
Maine	YES	YES	---	---	YES	YES	YES	DEV
Michigan	YES	YES	---	---	YES	YES	YES	YES
Nevada	YES	NO	NO	YES	NO	YES	YES	YES
New Jersey	YES	YES	YES	YES	YES	YES	YES	DEV
New York	YES	YES	YES	YES	NO	YES	YES	DEV
Oregon	YES	YES	NO	YES	NO	YES	YES	YES
South Carolina	NO	YES	NO	NO	YES	YES	YES	DEV
Texas	---	---	---	---	---	YES	YES	YES
Vermont	YES	YES	YES	YES	YES	YES	YES	YES
Virginia	YES	YES	YES	YES	DEV	YES	YES	NO
Washington	YES	YES	NO	YES	YES	YES	YES	NO

From: Battelle Memorial Institute,
Program for the Management of Hazardous Wastes
July 1973

TABLE 40 (Continued)

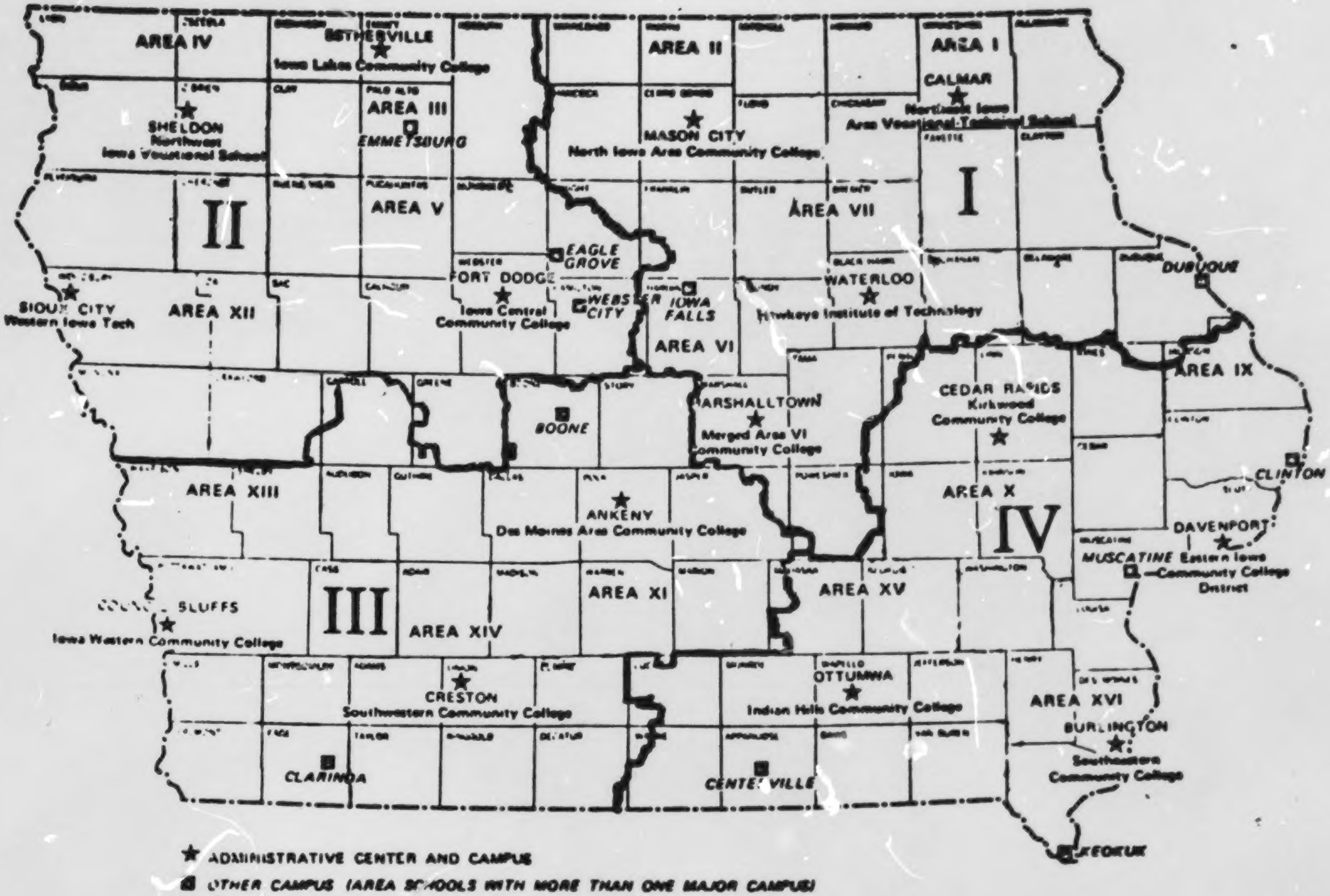
	RADIOACTIVE MATERIAL REGULATIONS ON				PESTICIDES REGULATIONS ON			
	DISPOSAL	TRANSPORTATION	PROCESSING	STORAGE	DISPOSAL	TRANSPORTATION	PROCESSING	STORAGE
Alabama	YES	YES	YES	YES	YES	YES	YES	YES
California	YES	YES	YES	YES	YES	YES	YES	YES
Colorado	YES	NO	NO	NO	NO	NO	NO	NO
Illinois	YES	YES	YES	YES	YES	YES	YES	YES
Kansas	YES	YES	YES	YES	YES	YES	YES	YES
Maine	YES	YES	YES	YES	YES	NO	NO	NO
Michigan	YES	YES	YES	YES	YES	YES	YES	YES
Nevada	YES	YES	YES	YES	YES	NO	NO	YES
New Jersey	YES	YES	YES	YES	YES	NO	NO	NO
New York	YES	YES	YES	YES	YES	NO	NO	NO
Oregon	YES	NO	NO	NO	YES	YES	NO	YES
South Carolina	YES	NO	NO	YES	NO	NO	NO	NO
Texas	YES	YES	YES	YES	NO	---	YES	YES
Vermont	YES	YES	YES	YES	YES	NO	NO	NO
Virginia	YES	YES	YES	YES	YES	NO	NO	NO
Washington	YES	NO	NO	NO	YES	NO	NO	NO

	SOLID WASTE		AIR QUALITY			WATER QUALITY		
	DISPOSAL REGULATIONS	LICENSING OF DISPOSAL SITES	EMISSION STANDARDS	AMBIENT STANDARDS	DISCHARGE PERMITS	EMISSION STANDARDS	AMBIENT STANDARDS	DISCHARGE PERMITS
Alabama	YES	YES	YES	YES	YES	YES	YES	YES
California	YES	YES	YES	YES	YES	YES	YES	YES
Colorado	YES	YES	---	---	---	---	---	---
Illinois	DEV	YES	YES	YES	YES	YES	YES	YES
Kansas	YES	YES	YES	YES	YES	YES	YES	YES
Maine	DEV	NO	---	YES	YES	NO	YES	YES
Michigan	YES	YES	YES	YES	YES	---	---	NO
Nevada	NO	NO	YES	YES	YES	YES	YES	YES
New Jersey	YES	YES	---	YES	YES	NO	YES	YES
New York	YES	YES	---	YES	YES	NO	YES	YES
Oregon	YES	YES	YES	YES	YES	YES	YES	YES
South Carolina	YES	YES	(YES)	(YES)	---	YES	YES	DEV
Texas	YES	YES	YES	YES	YES	YES	YES	YES
Vermont	NO	NO	---	YES	YES	NO	YES	YES
Virginia	YES	NO	---	YES	YES	NO	YES	YES
Washington	YES	YES	YES	YES	YES	YES	YES	YES

APPENDIX A

MAP OF AREA SCHOOL QUADRANT BOUNDARIES
SURVEY INSTRUMENTS AND INSTRUCTIONS

AREA SCHOOL QUADRANTS


AREA IV
ESTHERVILLE
Iowa Lakes Community College
AREA II
AREA I
CALMAR
Northeast Iowa Area Vocational-Technical School
SHELDON
Northwest Iowa Vocational School
AREA III
EMMETSBURG
MASON CITY
North Iowa Area Community College
II
AREA V
AREA VII
I
EAGLE GROVE
FORT DODGE
Iowa Central Community College
WEBSTER CITY
IOWA FALLS
WATERLOO
Hawkeye Institute of Technology
DUBUQUE
SIOUX CITY
Western Iowa Tech
AREA XII
AREA VI
AREA IX
CEDAR RAPIDS
Kirkwood Community College
MARSHALLTOWN
Merged Area VI Community College
BOONE
CLINTON
AREA XIII
ANKENY
Des Moines Area Community College
AREA X
IV
DAVENPORT
MUSCATINE
Eastern Iowa Community College District
COUNCIL BLUFFS
Iowa Western Community College
III
AREA XIV
AREA XI
AREA XV
CRESTON
Southwestern Community College
OTTUMWA
Indian Hills Community College
AREA XVI
BURLINGTON
Southeastern Community College
CLARINDA
CENTERVILLE
KEOKUK
★ ADMINISTRATIVE CENTER AND CAMPUS
▣ OTHER CAMPUS (AREA SCHOOLS WITH MORE THAN ONE MAJOR CAMPUS)

Office Use Only

Date ____________________

Time ____________________

Quadrant ____________________

Interviewer ____________________

STATE OF IOWA: INVENTORY OF SPECIAL SUBSTANCES AND MANPOWER CHARACTERISTICS OF HANDLERS

DEFINITION: Substances or materials which require careful handling so as to protect the well-being of the worker and his environment. They generally are hazardous under certain circumstances.

Does this firm have or use substances as defined above?

☐ YES ☐ NO

CONFIDENTIALITY STATEMENT
THE INFORMATION REPORTED IN THIS SURVEY WILL BE USED FOR PLANNING PURPOSES ONLY. COMPANY IDENTITIES WILL BE KEPT CONFIDENTIAL.

INSTRUCTIONS Please fill in all appropriate blanks. This form is prepared for ease in use and will accommodate those firms who use more than one type of special substances, i.e., flammable, explosive, pathological, toxic, corrosive, reactive, or unclassified. Therefore the number of blanks to complete will depend on the number of different types of substances in use. Detailed instructions are included and appropriately referenced by part and number. If you need additional assistance, please call COLLECT 515-424-9071. Thank you for your consideration and your help.

(Column A)	(Column B)		(Column C)
PART I 1. Total # of Company employees ______ 2. Total # who handle hazardous substances (include all job classifications) ______	Check below by type the job category of all persons included in question #1-3. (Refer to instructions for definitions).		List by chemical name or trade name all potentially dangerous substances handled by employees included in Column A. (Use additional sheets if necessary).
3. Total handling each type (# of employees) A. FLAMMABLE substance ______ (e.g., paint and cleaning solvents, waste oil products, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	1. ______ ______
B. EXPLOSIVE substance ______ (e.g., old dynamite and old dynamite packages, fulminate and azides, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	2. ______ ______
C. PATHOLOGICAL substance ______ (e.g., surgical wastes, used dressings, diseased carcasses, biological culture materials, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	3. ______ ______
D. TOXIC substance ______ (e.g., pesticides, heavy metal sludge, paint stripper, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	4. ______ ______
E. CORROSIVE substance ______ (e.g., acid plating solution, caustic paint stripper, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	5. ______ ______
F. REACTIVE substance ______ (e.g., unreacted polymers, peroxides, perchlorates, etc.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	6. ______ ______
G. UNCLASSIFIED substance ______ (potentially hazardous, but other than identified above.)	☐ Administrator ☐ Supervisor ☐ Clerk ☐ Professional	☐ Inspector ☐ Craftsman ☐ Operator ☐ Handler	7. ______ ______

EMPLOYEES WHO HANDLE HAZARDOUS SUBSTANCES

COLUMN D	COLUMN E	COLUMN F	COLUMN G
JOB CATEGORY Please complete. Vertical total equals Part I, #2 (Refer to instruction for generalized titles).	JOB LONGEVITY (On the average, please estimate).	Type of potentially dangerous substances handled. (Please check (✓) all appropriate types of substances).	Functions performed in handling the type of substances checked in Column F. (Please check (✓) all appropriate functions). See instructions for clarification.
1a. ADMINISTRATOR ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
2a. SUPERVISOR ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
3a. CLERK ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
4a. PROFESSIONAL ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
5a. INSPECTOR ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
6a. CRAFTSMAN ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
7a. OPERATOR ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine
8a. HANDLER ____ (Job category) b. # Currently employed ____	Av. yrs. with company ____ Av. yrs. present job ____ # Replacements per yr. ____ Anticipated needs next yr. ____	☐ Flammable ☐ Toxic ☐ Explosive ☐ Corrosive ☐ Pathological ☐ Reactive ☐ Unclassified	☐ Supervises ☐ Charts ☐ Stores ☐ Transports/Moves ☐ Receives ☐ Packages ☐ Processes ☐ Disposes ☐ Loads ☐ Applies by Hand ☐ Other ☐ Mixes ☐ Applies by Machine

PART II 1. Industry generally requires employees handling hazardous substances (HS) to have certain competencies. On the average, how would you rate your employees who handle HS in the competencies listed below?

	Above Average	Adequate	Needs Improvement	Not Applicable
a. Technical knowledge.				
b. Knowledge of rules and regulations pertaining to handling, storage, disposing of HM.				
c. Compliance with company policies, rules and practices.				
d. Knowledge of classes of HM, proper DOT shipping names, packaging, labels, marking and documentation requirements.				
e. Familiarity with the "Loading and Storage Chart" of the Department of Transportation.				
f. Knowledge of safety requirements in various work areas.				
g. Ability to recognize by name substances restricted by law.				
h. Knowledge of hazardous chemicals and their uses.				
i. Knowledge of non-compatible substances and reactions.				
j. Knowledge of relationships between HM, irritants and allergies.				
k. Ability to recognize agents causing potential health problems and proper precautions.				
l. Knowledge of the proper procedures for handling, disposal and/or decontamination in case of accident or incidents.				
m. Knowledge of attendance requirements when hazardous substances are being transported.				
n. Ability to report full details concerning any incident, including detailed information as to cause, damage, and corrective action taken.				
o. Knowledge of what information to pass on to firemen, police and others should an emergency arise.				
p. Knowledge of sources of help and information to be used when emergencies occur and when unrecognizable chemicals are encountered.				
q. When damaged containers are discovered, ability to isolate and take proper measures for further transportation.				
r. Knowledge of proper fire prevention and extinquishing measures.				

2. Please estimate the educational background of the employees you included in Part I, question 3, column A, according to types of materials they handle:
(A) Flammable, (B) Explosive, (C) Pathological, (D) Toxic, (E) Corrosive, (F) Reactive, or (G) Unclassified.

Remember, we are interested only in those employees who handle hazardous or potentially hazardous substances. Give the approximate number of employees for each level.

a. Waste type ________
(A,B,C,D,E,F, or G)
Less than H.S. ________
H.S. or equivalent ________
Post secondary ________
Degree ________
Graduate ________
TOTAL ________

b. Waste type ________
(A,B,C,D,E,F, or G)
Less than H.S. ________
H.S. or equivalent ________
Post secondary ________
Degree ________
Graduate ________
TOTAL ________

c. Waste type ________
(A,B,C,D,E,F, or G)
Less than H.S. ________
H.S. or equivalent ________
Post secondary ________
Degree ________
Graduate ________
TOTAL ________

d. Waste type ________
(A,B,C,D,E,F, or G)
Less than H.S. ________
H.S. or equivalent ________
Post secondary ________
Degree ________
Graduate ________
TOTAL ________

e. TOTALS FOR ALL WASTE TYPES
Enter approximate totals for all individual employees regardless of type of substance handled.
Less than H.S. ________
H.S. or equivalent ________
Post secondary ________
Degree ________
Graduate ________
TOTAL ________

PART III SURVEY OF TRAINING RELATED TO SPECIAL SUBSTANCES

Many employers provide or sponsor training programs for their employees. This survey is interested in obtaining information only about training programs which are related to the specific job requirements of persons who contact hazardous substances. We would like this information for each type of hazardous substance contacted.

CODE Identify types by letter(s).

A. Flammable	D. Toxic
B. Explosive	E. Corrosive
C. Pathological	F. Reactive
G. Unclassified	

	YES	NO	FOR SUPERVISORY	LESS THAN SUPERVISORY	RELATED TO HAZARDOUS SUBSTANCE TYPE(S)
1. Does your firm provide job-related training for employees in handling hazardous substances?	☐	☐	☐	☐	
2. Is any of this training provided at the plant site?	☐	☐	☐	☐	______
3. Is this training provided at another location?	☐	☐	☐	☐	______
a. If YES, where ______________?					______
4. Is this training conducted informally (through specific instruction provided as needed)?	☐	☐			
a. If YES, how? (Please check).					
1. Hands-on ☐ Work site ☐ No. of hours ______			☐	☐	______
2. Other ☐ Work site ☐ No. of hours ______			☐	☐	______
5. If structured, is it classroom training conducted on-site?	☐	☐	☐	☐	______
a. Indicate number of hours of training for each employee. ______					
6. If structured is it classroom training conducted off-site?	☐	☐	☐	☐	______
a. Indicate number of hours of training for each employee. ______					
7. Is this classroom training conducted for one time only?	☐	☐	☐	☐	______
a. If NO, is this classroom training on-going for each employee being trained?	☐	☐	☐	☐	______

8. Estimate the number of employees trained in the past year, by type of hazardous substance (as coded in the box at upper right) in the following subject areas. Estimate for both your structured or formal training and your informal training:

	RELATED TO HAZARDOUS SUBSTANCE TYPE(S)	STRUCTURED (No. of Employees)	INFORMAL (No. of Employees)
a. Safety	______	______	______
b. Recognition	______	______	______
c. Vocational	______	______	______
d. Supervisory	______	______	______

	RELATED TO HAZARDOUS SUBSTANCE TYPE(S)	STRUCTURED (No. of Employees)	INFORMAL (No. of Employees)
e. First Aid	______	______	______
f. Other (specify)	______	______	______

g. If no training was provided, check here. ☐

PART IV DEFINITION: Special waste which requires special handling and which must be disposed of in such a manner as to protect the public health and conserve the environment.

1. Complete the following information about volumes of special wastes generated at this plant site from the substances listed in Column C, page 1.

IMPORTANT

Indicate monthly or annualized quantity generation rate and unit of measure used for each form of waste.

LIQUID_____ _____ Avg. Per ______.
SLUDGE_____ _____ Avg. Per ______.
SOLID _____ _____ Avg. Per ______.
GAS _____ _____ Avg. Per ______.
Example:(2000 tons Avg. Per Year)

WASTE CHARACTERISTIC		VOLUME(S) OF SPECIAL WASTE																		PLEASE CHECK (✓) TYPE OF LABELING USED ON STORED WASTES				
		TRANSPORTED FROM PLANT		TREATMENT AT PLANT SITE (Must equal 100% of volume by type)						DISPOSAL METHOD (Must equal 100% of volume by type)								STORED AT PLANT SITE OVER 24 HR.						
														Recycle/Reuse										
TYPE	FORM	By Company	By Outside Contract	Chemical	In-cineration	Solidification	Neutralization	Other	None	Sewer	Company Site Land-fill	Municipal Sanitary Land-fill	Out-of-State	By Company	By Outside Contract	Other	Unknown	In-doors	Out-Doors	Warning of Hazard	Ingredients	Emergency Procedures	Other	None
FLAMMABLE WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
EXPLOSIVE WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
PATHOLOGICAL WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
TOXIC WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
CORROSIVE WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
REACTIVE WASTE	liquid																							
	sludge																							
	solid																							
	gas																							
UN-CLASSIFIED WASTE	liquid																							
	sludge																							
	solid																							
	gas																							

- Office use only

Date ____
Time ____
Quadrant ____
Interviewer No. ____

STATE OF IOWA: EMPLOYEE INVENTORY OF SPECIAL MANPOWER CHARACTERISTICS, SPECIAL SUBSTANCES USED, AND TRAINING.

DEFINITION: Substances or materials which require careful handling so as to protect the well-being of the worker and his environment. They generally are hazardous under certain circumstances.

Does this firm have or use substances under the above definition? ☐ Yes ☐ No

CONFIDENTIALITY STATEMENT
THE INFORMATION REPORTED IN THIS SURVEY WILL BE USED FOR PLANNING PURPOSES ONLY. EMPLOYEES' IDENTITIES WILL BE KEPT CONFIDENTIAL.

Part I

1. Name of Industry ____
5. SIC CODE ____ (4 digit)
2. Address ____ (Work Site)
3. ____ (City)
4. ____ (ZIP)
6. ____ (Birth Date)
7. ____ (Job Title)
8. ____ (DOT NO. - IF KNOWN)
9. Time with Company ____ (No. of Yrs.)
10. Time at Present Job ____ (No. of Yrs.)

Education:

11. Highest Grade Completed ____
12. Degrees or Certificates Earned ____

Part II

1. Enter total number of employees who handle any hazardous materials or substances for whom you have supervisory responsibility. (If none, enter 0) ☐

2. List below, in Column A, by chemical name, or other wise identify, materials or substances used or handled by you as a part of your employment. Include only those materials you feel are or may constitute a danger or hazard. (If you do not use substances you consider constitute a danger, skip to page 2, Part IV.)

(Column A)
(Use only as many blanks as needed)

a. ____
b. ____
c. ____
d. ____
e. ____
f. ____
g. ____
h. ____
i. ____
j. ____
k. ____
l. ____

3. What is the average number of hours per day you come in contact (e.g., handle, process, use, transport, store, dispose of etc.) with the above materials? ____

For office use only

(Column B)
Type

a. ____
b. ____
c. ____
d. ____
e. ____
f. ____
g. ____
h. ____
i. ____
j. ____
k. ____
l. ____

Part III

1. On page 1, you indicated materials you use in your work. Below, please check the functions you perform in using these materials.

a. ☐ Supervise work of others.
b. ☐ Receive (from others).
c. ☐ Load.
d. ☐ Mix for use.
e. ☐ Chart (record).
f. ☐ Apply by hand.
g. ☐ Apply by machine.
h. ☐ Package.
i. ☐ Store.
j. ☐ Transport or move to another location.
k. ☐ Process.
l. ☐ Dispose.
m. ☐ Other What?__________________

	YES	NO	DON'T KNOW
2. Does your company provide job related training for its employees in the proper use of these materials?	☐	☐	☐
3. Is the training provided in a classroom?	☐	☐	☐
a. If YES, where? (Please check) 1. At the plant?	☐	☐	☐
2. At another location?	☐	☐	☐
4. Is the training provided informally on-the-job?	☐	☐	☐
5. Approximately how many hours of training have you had this past year in the proper use and/or handling of hazardous materials?____			☐

6. Indicate kind of training received. How many hours did you receive?

a. ☐ Safety	______ hrs.
b. ☐ Recognition of hazardous materials	______ hrs.
c. ☐ Vocational (job related)	______ hrs.
d. ☐ First aid	______ hrs.
e. ☐ Supervisory	______ hrs.
f. ☐ Other What?__________	______ hrs.

7. Is the Company training given to you one time only, or is it on-going?

☐ One time
☐ On-going

Part IV

1. Industry generally requires employees handling hazardous materials (H/M) to have certain compentancies. On the average how would you rate yourself and others with whom you work in the following areas?

	ABOVE AVERAGE	ADEQUATE	NEEDS IMPROVEMENT	NOT APPLICABLE	[illegible]
a. Technical knowledge.					
b. Knowledge of rules and regulations pertaining to handling, storage, disposing of H/M.					
c. Compliance with company policies, rules, and practices.					
d. Knowledge of classes of H/M, proper DOT shipping names, packaging, labels, marking and documentation requirements.					
e. Familiarity with "Loading and Storage Chart" of the Department of Transportation.					
f. Knowledge of safety requirements in various work areas.					
g. Ability to recognize restricted substances by name.					
h. Knowledge of hazardous chemicals and their uses.					
i. Knowledge of non-compatible materials and reactions.					
j. Knowledge of relationships between H/M, irritants and allergies.					
k. Ability to recognize agents causing potential health problems and proper precautions.					
l. Knowledge of the proper procedures for handling, disposal and/or decontamination in case of accident or incidents.					
m. Knowledge of attendance requirements when hazardous substances are being transported.					
n. Ability to report full details concerning any H/M incident, including detailed information as to cause, damage, and correct action taken.					
o. Knowledge of what information to pass on to firemen, police and others should an emergency arise.					
p. Knowledge of sources of help and information to be used when emergencies occur and when unrecognizable chemicals are encountered.					
q. When damaged containers are discovered, ability to isolate and take proper measures for further transportation.					
r. Knowledge of proper fire prevention and extinguishing measures.					

Office Use Only

Date__________________

Time__________________

Interviewer______________

STATE OF IOWA SURVEY OF REGULATORY AGENCIES AND THEIR PRIMARY OR LIMITED AUTHORITY REGARDING HAZARDOUS SUBSTANCES

This survey is jointly funded by several State agencies. One of its purposes is to assist the State of Iowa to develop a plan for the management of hazardous substances, excluding radioactive substances. To maintain proper perspective it is essential to analyze existing authority.

DEFINITION: Substances which require careful handling so as to protect the well-being of the worker and his environment. They generally are hazardous under certain circumstances and may be classified as: flammable, explosive, pathological, toxic, corrosive or reactive.

The information reported on this form is for planning purposes only. Identities of individual respondents will not be divulged.

PART I:

1. Name of Agency __________________ 2. Office __________________

3. Address ____________ 4. City ____________ 5. Zip ______ 6. Telephone __________

5. Person Interviewed __________________ 8. Title __________________

PART II:

The purpose of this study is to gain information regarding both primary and limited authority over the management of hazardous materials (HM). We define primary as "having mainline authority under normal circumstances," and limited as "under limited or unusual circumstances." We identify four types of legal powers: ADJUDICATORY: having quasi-judicial powers, such as the right to hold hearings, grant permits, etc.; REGULATORY: having power to make rules; ADVISORY: having power to recommend actions; ENFORCEMENT: having power to assure compliance.

In administering its statutes, would your agency exercise one or more of the four types of authority through any of the activities listed below? Please check Yes or No for each. When this authority is not broad and general, but initiated only under certain circumstances, please specify what these are.

A. ADJUDICATORY POWERS

1. Approve labeling of HM? ☐ No ☐ Yes (specify) __________ ☐ D.K.
2. Inspect stored containers of HM? ☐ No ☐ Yes (specify) __________ ☐ D.K.
3. Certify commercial applicators of HM? ☐ No ☐ Yes (specify) __________ ☐ D.K.
4. License vehicles transporting HM? ☐ No ☐ Yes (specify) __________ ☐ D.K.
5. Conduct hearings on causes of accidents? ☐ No ☐ Yes (specify) __________ ☐ D.K.
6. Issue operational permits? ☐ No ☐ Yes (specify) __________ ☐ D.K.
7. Approve actions initiated by other state agencies? ☐ No ☐ Yes (specify) __________ ☐ D.K.
8. Other? ☐ No ☐ Yes (specify) __________ ☐ D.K.

REGULATORY POWERS

1. Require accident and emergency reports? ☐ No ☐ Yes (specify) ____
☐ D.K.

2. Prohibit open burning of HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

3. Require licensing of shippers of HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

4. Regulate size, location, structure, and labeling of storage tanks and areas? ☐ No ☐ Yes (specify) ____
☐ D.K.

5. Restrict sale and distribution of certain HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

6. Regulate disposal of HM on public property? ☐ No ☐ Yes (specify) ____
☐ D.K.

7. Regulate disposal of HM on private property? ☐ No ☐ Yes (specify) ____
☐ D.K.

8. Other? ☐ No ☐ Yes (specify) ____
☐ D.K.

C. ADVISORY POWERS

1. Evaluate hazards associated with the safety and health of workers handling HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

2. Initiate research in improving health and safety conditions for workers handling HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

3. Conduct demonstrations of improved methods of safeguarding working environments of persons handling HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

4. Provide technical assistance to communities and/or industry ? ☐ No ☐ Yes (specify) ____
☐ D.K.

5. Conduct training activities for emergency handling of HM? ☐ No ☐ Yes (specify) ____
☐ D.K.

6. Act in advisory capacity to other state agencies? ☐ No ☐ Yes (specify) ____
☐ D.K.

7. Other? ☐ No ☐ Yes (specify) ____
☐ D.K.

ENFORCEMENT POWERS

1. Issue orders directing compliance? ☐ No ☐ Yes (specify) ______ ☐ D.K.

2. Carry out preventive and control measures? ☐ No ☐ Yes (specify) ______ ☐ D.K.

3. Require documents, e.g., safety certifications, bills of lading, accident reports, etc.? ☐ No ☐ Yes (specify) ______ ☐ D.K.

4. Assess penalties? ☐ No ☐ Yes (specify) ______ ☐ D.K.

5. Exercise emergency powers when imminent danger exists? ☐ No ☐ Yes ___ (specify) ______ ☐ D.K.

6. Seek injunctions or stay orders? ☐ No ☐ Yes (specify) ______ ☐ D.K.

7. Initiate court action against violators of HM regulations? ☐ No ☐ Yes (specify) ______ ☐ D.K.

8. Other? ☐ No ☐ Yes (specify) ______ ☐ D.K.

PART III:

The purpose of this Part is to determine the extent of interagency cooperation, the agency's relationship with the legislature, and staff training in regard to regulations related to the handling of hazardous materials (HM).

1. Is your agency presently a member of any interagency committee (ad hoc, temporary, or standing) which mutually determines policy in matters involving hazardous materials (HM):

In emergency situations? 1a. Yes ☐ No ☐

In operational procedures? 1b. Yes ☐ No ☐

If Yes, give name of committee ______

If No, move directly to question 2, next page.

Please check the members of this committee:

1c. ☐ Department of Transportation
1d. ☐ Department of Agriculture
1e. ☐ Department of Environmental Quality
1f. ☐ Department of Public Health
1g. ☐ Department of Soil Conservation
1h. ☐ Commerce Commission
1i. ☐ Natural Resources Council
1j. ☐ Bureau of Labor
1k. ☐ Civil Defense Division
1l. ☐ Department of Public Safety
1m. ☐ Other

How often does this committee meet? 1n. ☐ Monthly 1o. ☐ Bimonthly 1p. ☐ Annually 1q. ☐ Semi-annually 1r. ☐ Other

In an emergency involving HM, does your agency ever assume the primary responsibility? 1s. ☐ Yes ☐ No

If yes, which type of emergency? 1t. ______

Has this committee ever initiated legislative recommendations impacting on HM to the General Assembly? 1u. ☐ Yes ☐ No

If yes, what were they?

	Title or Number		Year		Outcome
1v.	______	1w.	______	1x.	______

PART III: (continued)

2. Does your agency maintain active liaison with the General Assembly?

☐ Yes ☐ No

3. Prior to 1975, has your agency ever initiated legislative recommendations impacting on HM to the General Assembly? ☐ Yes ☐ No ☐ D.K.

If yes, what were they?

	Title or Number		Year		Outcome
3a.	______	3b.	______	3c.	______
	______		______		______
	______		______		______

4. Did your agency recommend such legislation to the 66th General Assembly?

☐ Yes ☐ No

If yes, what was it?

	Title or Number		Outcome
4a.	______	4b.	______
	______		______
	______		______

5. Do you know of any Bills impacting on hazardous substances (other than those mentioned above) currently before the General Assembly?

☐ Yes ☐ No

If yes, please identify the Bills by title or number:

5a. ☐ ______
5b. ☐ ______
5c. ☐ ______
5d. ☐ ______

6. Do any Federal agencies affect your agency's administrative or operational activities? ☐ Yes ☐ No If yes, please state, for each type of effect, the name of the agency.

		Federal Agency
6a.	☐ Preemption	______
6b.	☐ Overlapping	______
6c.	☐ Duplication	______
6d.	☐ Other	______

7. Do any other Iowa State agencies affect your agency's administrative or operational activities? ☐ Yes ☐ No If yes, please state for each type of effect, the name of the agency.

		Iowa State Agency
7a.	☐ Preemption	______
7b.	☐ Overlapping	______
7c.	☐ Duplication	______
7d.	☐ Other	______

8. Does any Federal agency require your agency to adopt by statute its regulations? ☐ Yes ☐ No ☐ Don't know.

9. What is the policy of your agency regarding its authority over accidents or other emergency occurences involving HM? Please include such topics as coordination with other agencies, methods of implementation, etc.

______
______
______

10. Has your agency adopted as regulations the standards of any private organizations or associations? ☐ Yes ☐ No

10a. If yes, which organizations?

______ ______
______ ______

11. Does the staff of your agency actively investigate accidents or emergency occurrences involving HM? ☐ Yes ☐ No

If yes, answer questions 11a. through 11k.

11a. Does your agency have primary investigative responsibility?
☐ Yes ☐ No

11b. Does your agency have secondary investigative responsibility?
☐ Yes ☐ No

11c. If yes, who notifies your agency of the incident?

______
______

How are staff members trained to conduct such investigation?

11d. ☐ in-house training
11e. ☐ by other government agency
11f. ☐ by outside contract
11g. ☐ other
11h. How many were so trained during the past year? ______

Of these, how many were administrators? 11i. ☐ ______
How many were supervisors? 11j. ☐ ______
Less than supervisory level? 11k. ☐ ______

APPENDIX B

MANPOWER TABLES

TABLE 1

ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE AND QUADRANT

	Estimated number of firms				
		Quadrant			
Type of substance handled	State total*	I	II	III	IV
Flammable	1,379 (1,228-1,529)	359	225	365	430
Pathological	343 (238-448)	107	67	70	99
Toxic	1,316 (1,147-1,485)	318	288	272	438
Corrosive	513 (399-627)	102	126	98	187
Explosive-reactive	91 (37-148)	**	**	**	41
Unclassified	79 (38-120)	11	**	19	44

*The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 2

ESTIMATED NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE AND QUADRANT

	Estimated number of employees				
		Quadrant			
Type of substance handled	State total*	I	II	III	IV
Flammable	16,597 (14,082-19,112)	5,332	1,676	3,672	5,917
Pathological	988 (648-1,328)	274	170	250	294
Toxic	9,839 (8,015-11,663)	2,419	1,487	2,026	3,907
Corrosive	6,459 (5,284-7,634)	1,460	569	927	3,503
Explosive-reactive	1,602 (1,010-2,194)	630	**	**	727
Unclassified	939 (591-1,287)	310	**	343	266

*The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 3

ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY TYPE OF SUBSTANCE HANDLED AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Type of substance handled						
	Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified	Total*
07	106	320	356	**	**	**	413 (316-510)
22,29,31,32,37	13	**	**	6	**	**	14 (12-16)
24	36	**	**	**	**	**	36 (8-64)
26	22	**	8	15	**	**	25 (17-33)
27	601	**	497	74	**	**	707 (637-777)
28	173	**	256	193	49	**	318 (274-362)
30	17	**	12	**	**	**	22 (15-29)
33	29	**	17	11	**	13	36 (30-42)
34,39	290	**	114	95	35	**	349 (293-405)
35	66	**	33	30	**	15	67 (52-82)
36	26	**	18	21	**	**	34 (23-45)
Total*	1,379 (1,228-1,529)	343 (238-448)	1,316 (1,147-1,485)	513 (399-627)	91 (37-148)	79 (38-120)	2,021 (1,873-2,169)

* The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 4

ESTIMATED AVERAGE NUMBER OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES PER FIRM CLASSIFIED BY TYPE OF SUBSTANCE HANDLED AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Type of substance handled						
	Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified	Total*
07	2.8	2.6	2.6	**		**	3.0 (2.4-3.6)
22,29,31,32,37	7.3		**	11.5	**	**	11.4 (6.5-16.4)
24	6.5		**			**	6.8 (5.1-8.5)
26	28.0		19.8	11.2		**	27.4 (21.1-33.8)
27	4.5	**	3.3	2.5	**	**	4.7 (3.3-6.1)
28	18.0	**	13.6	13.5	19.4	**	17.3 (12.1-22.5)
30	64.2		15.1	**	**	**	66.7 (17.2-116.2)
33	62.4		29.9	120.5		3.4	62.8 (51.0-74.5)
34,39	13.1	**	6.4	9.1	16.0	**	14.2 (11.4-17.0)
35	27.4	**	34.0	27.0	**	10.9	39.3 (9.0-69.7)
36	40.5	**	58.7	11.5	**	**	46.9 (29.3-64.5)
Total *	12.0 (9.7-14.4)	2.9 (2.3-3.4)	7.5 (5.9-9.1)	12.6 (9.5-15.6)	17.6 (9.1-26.1)	11.9 (6.1-17.7)	11.9 (9.9-13.9)

*The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 5

ESTIMATED MANPOWER CHARACTERISTICS OF EMPLOYEES HANDLING HAZARDOUS SUBSTANCES CLASSIFIED BY POSITION*

	Position							
	Administrator	Supervisor	Clerk	Professional	Inspector	Craftsman	Operator	Handler
Estimated Total No. of Employees	542 (359-725)	1,961 (1,561-2,361)	289 (192-386)	1,130 (885-1,375)	338 (287-389)	4,873 (3,997-5,749)	10,512 (8,710-12,314)	4,386 (3,560-5,212)
Estimated Average Years With Company	15.26 (11.84-18.68)	10.99 (9.43-12.09)	7.22 (4.21-10.23)	10.88 (7.71-14.00)	10.06 (8.33-11.79)	7.75 (6.23-8.99)	6.40 (5.03-7.77)	5.21 (4.26-6.08)
Estimated Average Years at Present Job	14.38 (10.82-17.94)	8.80 (7.07-9.86)	6.60 (3.75-9.46)	10.66 (7.45-13.76)	7.65 (5.82-9.47)	6.78 (5.34-7.95)	5.76 (4.36-7.15)	4.62 (3.61-5.52)
Estimated Average No. of Replacements per Year	.04 (.02-.05)	.27 (.15-.36)	.22 (.09-.35)	.25 (.04-.45)	2.21 (1.76-2.65)	.66 (.43-.82)	1.82 (1.47-2.16)	1.61 (.96-2.17)
Estimated Average Projected Needs Next Year	.13 (.03-.21)	.38 (.21-.52)	.43 (.21-.65)	.47 (.23-.70)	2.61 (2.03-3.03)	1.13 (.52-1.70)	2.31 (1.23-3.38)	1.30 (1.01-1.57)

*The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 6

ESTIMATED MANPOWER CHARACTERISTICS OF FIRMS CLASSIFIED BY POSITION AND TYPE OF SUBSTANCE HANDLED

	Estimated number of firms with one or more employees handling hazardous substances*					
	Type of substance handled					
Position	Flammable	Pathological	Toxic	Corrosive	Reactive/ Explosive	Unknown
Administrator	250 (151-349)	** **	265 (166-364)	83 (40-126)	** **	** **
Supervisor	414 (321-506)	** **	300 (230-370)	197 (148-246)	38 (14-82)	18 (11-31)
Clerk	36 (22-54)	** **	78 (26-130)	34 (18-76)	** **	** **
Professional	148 (74-222)	271 (178-364)	334 (231-437)	106 (50-162)	13 (10-19)	** **
Inspector	30 (23-39)	** **	16 (13-25)	17 (14-24)	8 (6-16)	** **
Craftsman	557 (442-672)	** **	391 (292-490)	112 (65-159)	11 (8-18)	10 (7-17)
Operator	576 (479-673)	** **	441 (350-532)	248 (200-296)	53 (29-77)	33 (16-52)
Handler	446 (361-531)	89 (28-150)	359 (271-447)	192 (140-244)	69 (30-108)	35 (20-50)

** Five sample firms or fewer reporting

* The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 7

ESTIMATED MANPOWER CHARACTERISTICS OF FIRMS CLASSIFIED BY JOB FUNCTION AND POSITION

	Estimated number of firms with one or more employees handling hazardous substances*							
	Position							
Job Function	Administrator	Supervisor	Clerk	Professional	Inspector	Craftsman	Operator	Handler
Supervises	296 (195-397)	545 (440-650)	** **	212 (128-296)	10 (8-18)	91 (35-147)	77 (36-118)	** **
Receives	222 (126-318)	253 (173-333)	88 (32-144)	241 (151-331)	** **	293 (198-388)	341 (264-418)	268 (187-349)
Loads	218 (125-311)	223 (144-302)	** **	185 (99-271)	** **	331 (230-432)	472 (380-564)	325 (249-401)
Mixes	189 (108-270)	209 (148-270)	36 (6-82)	221 (132-310)	** **	332 (244-420)	354 (280-428)	233 (173-293)
Charts	179 (97-261)	109 (61-157)	54 (17-91)	135 (63-207)	10 (9-17)	82 (37-127)	91 (45-137)	54 (24-84)
Applies: By hand	255 (150-360)	198 (116-280)	** **	227 (133-321)	** **	459 (350-568)	388 (294-482)	322 (234-410)
By machine	162 (75-249)	195 (124-266)	** **	69 (16-122)	** **	380 (280-480)	554 (458-650)	183 (125-241)
Packages	** **	72 (27-117)	** **	74 (21-127)	** **	33 (11-55)	61 (31-91)	60 (21-99)
Stores	247 (146-348)	206 (129-283)	82 (26-138)	185 (103-267)	** **	200 (125-275)	253 (189-317)	319 (231-407)
Transports/moves	179 (92-266)	252 (168-336)	57 (15-101)	164 (86-242)	6 (6-12)	280 (198-362)	417 (337-497)	345 (273-417)
Processes	130 (49-211)	115 (68-162)	** **	109 (45-172)	7 (7-11)	216 (138-294)	186 (126-246)	86 (52-120)
Disposes	282 (181-383)	215 (136-294)	66 (14-118)	303 (202-404)	** **	372 (274-470)	393 (295-491)	266 (191-341)
Other	66 (17-115)	20 (6-38)	** **	88 (34-142)	14 (8-20)	112 (60-164)	44 (21-67)	113 (53-173)

** Five sample firms or fewer reporting

*The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 8

ESTIMATED NUMBER OF EMPLOYEES* CLASSIFIED BY EDUCATIONAL BACKGROUND AND QUADRANT

Educational Background	Estimated number of employees State total**	Quadrant I	II	III	IV
Less than high school	1,238 (950-1,526)	494	98	183	463
High school or equivalent	18,178 (15,693-20,663)	5,479	2,189	3,871	6,639
Post secondary	2,710 (2,089-3,331)	690	263	712	1,045
Degree	1,297 (1,016-1,578)	319	105	285	588
Graduate training	608 (395-821)	166	109	142	191
Total	24,031 (20,996-27,066)	7,148	2,764	5,193	8,926

*Includes only those employees who handle hazardous substances.

**The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 9

ESTIMATED AVERAGE LENGTH OF TRAINING PROGRAMS (IN HOURS) CLASSIFIED BY TYPE OF PROGRAM AND QUADRANT

	Estimated average length of programs (hours)				
	All firms *	Quadrant			
Type of training program		I	II	III	IV
Informal programs					
Hands on	56.81 (32.31-81.30)	47.07	51.98	77.94	49.50
Other	36.00 (23.95-48.05)	0.0	24.00	67.33	43.00
Structured programs					
On-going					
On-site	25.24 (18.29-32.19)	15.89	34.00	48.09	18.98
Off-site	20.51 (13.65-27.37)	15.60	35.44	12.56	17.17
One-time only					
On-site	17.69 (8.62 - 26.75)	0.0	0.0	12.50	18.43
Off-site	73.32 (10.68-171.08)	27.70	400.00	22.00	27.64

*The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 10

ESTIMATED NUMBER OF FIRMS HAVING TRAINING PROGRAMS CLASSIFIED BY TYPE OF PROGRAM AND QUADRANT

Type of training program	Estimated number of firms				
	State total*	Quadrant			
		I	II	III	IV
Safety	775 (660-890)	198	131	141	305
Recognition	435 (351-519)	132	70	55	178
Vocational	338 (255-421)	81	66	54	137
Supervisory	233 (163-303)	70	10	39	114
First aid	326 (234-419)	87	63	38	138
Other	83 (37-129)	43	29	2	9
Number of firms having at least one program	1,207 (1,086-1,328)	300	228	261	418
Number of firms having no program	814 (673-955)	197	164	205	248

*The 95% confidence interval is shown in parenthesis below the estimate.

APPENDIX C

INDUSTRIAL WASTE TABLES

TABLE 1

ESTIMATED AMOUNT OF SOLID HAZARDOUS WASTE GENERATED* CLASSIFIED BY TYPE OF WASTE AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Type of hazardous waste						
	Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified	Total***
07		395	31				426 (131-721)
22,29,31,32,37	**		**	**			6 (6-10)
24	15						15 (9-21)
26	552		**	**		**	3,066 (3,059-6,829)
27	70		15	**		**	91 (49-133)
28	36	**	993	**	**	**	456,745 454,999-1,602,505)
30	**		**			**	156 (132-210)
33	74,918		**	**		24,203	109,985 (97,774-122,195)
34,39	190		1,395	**	**	**	1,910 (1,878-1,942)
35	125		**	**		**	335 (196-655)
36	5		**	**		**	1,173 (1,173-1,421)
Total***	75,927 (75,850-76,007)	483 (190-777)	4,095 (3,526-4,664)	463,832 (454,482-1,602,318)	**	29,133 (23,748-38,749)	573,907 (557,591-1,705,364)

*Amount of solid waste is given in 1,000s of kilograms.

***The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 2

ESTIMATED AMOUNT OF NONSOLID HAZARDOUS WASTE GENERATED* CLASSIFIED BY TYPE OF WASTE AND MAJOR GROUP STANDARD INDUSTRIAL CLASSIFICATION

SIC code	Type of hazardous waste						
	Flammable	Pathological	Toxic	Corrosive	Reactive	Unclassified	Total ***
07			**				**
22,29,31,32,37	57			**	**	**	1,845 (1,845-1,854)
24	56		**				182 (182-183)
26	282		**	**		**	2,407 (2,380-2,478)
27	34		300	23		**	406 (241-657)
28	17,576	**	125	1,433	**	**	41,962 (19,058-96,512)
30	35		**	**		**	988 (567-2,231)
33	1,440		**	**			14,562 (14,170-15,859)
34,39	1,462		5,894	1,119	**	**	8,781 (8,214-10,047)
35	811		1,784	963		**	3,560 (2,819-7,201)
36	384		54	57,010		**	57,451 (57,381-57,807)
Total ***	22,138 (6,372-67,525)	**	10,427 (10,028-13,575)	73,790 (72,736-76,011)	**	3,046 (2,543-4,238)	132,156 (106,857-184,494)

*Amount of non-solid waste is given in 1,000s of liters.

*** The 95% confidence interval is shown in parenthesis below the estimate.

**Five sample firms or fewer reporting.

TABLE 3

ESTIMATED NUMBER OF FIRMS HANDLING HAZARDOUS MATERIAL BUT GENERATING NO HAZARDOUS WASTE CLASSIFIED BY QUADRANT

	Estimated number of firms			
State total*	Quadrant			
	I	II	III	IV
337 (222-452)	126 (54-198)	73 (19-127)	109 (41-177)	29 (10-60)

*The 95% confidence interval is shown in parenthesis below the estimate.

TABLE 4

ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED* BY IOWA FIRMS WITH MORE THAN 100 EMPLOYEES CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

	Estimated volume of hazardous waste***			
Method of handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company	237 (224-469)	1,228 (1,226-3,620)	461,834 (460,297-1,607,841)	
By outside contract	23,983 (23,527-25,383)	3,273 (2,312-4,969)	107,260 (100,040-125,541)	
Treatment at plant site				
Chemical	93,461 (85,808-133,687)	**		
Incineration		**	**	
Solidification		**	**	
Neutralization	8,456 (8,410-8,721)	1,130 (790-2,774)	29 (28-40)	
Other	**	**	4,796 (2,436-15,779)	
None	3,906 (3,458-7,418)	3,360 (2,740-5,717)	563,174 (552,549-1,700,345)	
Disposal methods				
Sewer	66,856 (66,746-69,867)	**	**	
Company site landfill	**	159 (159-160)	456,924 (455,581-1,603,119)	
Municipal landfill	66 (66-85)	2,758 (2,224-5,381)	3,199 (2,898-5,373)	
Out-of-state	440 (338-847)	110 (110-116)	**	
Recycle/Reuse				
By company	461 (460-465)		**	
By outside contract	14,357 (14,353-14,372)	**	2,631 (2,612-2,675)	
Other	22,887 (15,297-63,174)	**	3,028 (3,028-4,914)	
Unknown	1,180 (834-2,618)	1,470 (1,042-2,935)	28,414 (17,098-42,607)	

*Estimates given in 1,000s of units.

***The 95% confidence interval is shown in parenthesis below the estimate.

**Five firms or fewer reporting.

TABLE 5

ESTIMATED VOLUME OF HAZARDOUS WASTE GENERATED* BY IOWA FIRMS WITH 100 OR LESS EMPLOYEES CLASSIFIED BY FORM OF WASTE, AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

Method of handling	Estimated volume of hazardous waste *** Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company	2,295 (1,419-3,959)	255 (126-520)	624 (181-1,067)	**
By outside contract	410 (125-881)	16,114 (1,378-62,444)	3,851 (1,316-8,431)	
Treatment at plant site				
Chemical	**		244 (82-969)	
Incineration			252 (57-796)	
Solidification			92 (84-332)	
Neutralization	1,998 (1,325-3,906)	**	469 (55-883)	
Other	**		99 (10-271)	
None	2,229 (1,851-2,691)	16,367 (1,504-62,570)	3,635 (1,196-8,236)	**
Disposal methods				
Sewer	2,473 (2,047-3,415)		**	
Company site landfill	**	**	57 (24-117)	
Municipal landfill	283 (93-813)	92 (50-244)	1,269 (491-2,048)	
Out-of-state	**	**	**	
Recycle/Reuse				
By company	**		14 (4-28)	
By outside contract	104 (39-252)	**	336 (108-803)	
Other	357 (35-1,038)		368 (73-663)	**
Unknown	1,055 (1,006-2,977)	16,046 (1,349-62,414)	2,502 (790-7,716)	

*Estimates given in 1,000s of units.

***The 95% confidence interval is shown in parenthesis below the estimate.

**Five firms or fewer reporting.

TABLE 6

ESTIMATED VOLUMES OF FLAMMABLE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

Method of Handling	Liquid (liters)	Estimated volume of hazardous waste* Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company	514	1,264	48	**
By outside contract	15,867	17,089	75,857	
Treatment at plant site				
Chemical	**	**	**	
Incineration		**		
Solidification			**	
Neutralization	**	**	7	
Other	**	**	12	
None	2,180	18,368	75,899	**
Disposal methods				
Sewer	22	**		
Company site landfill	**	**	**	
Municipal landfill	313	1,537	736	
Out-of-state	267	196	**	
Recycle/Reuse				
By company	**		12	
By outside contract	1,236	**	156	
Other	54	**	25	**
Unknown	1,018	16,493	87	

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 7

ESTIMATED VOLUMES OF PATHOLOGICAL WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

Method of Handling	Liquid (liters)	Estimated volume of hazardous waste* Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company		**	**	
By outside contract			410	
Treatment at plant site				
Chemical	**	**	**	
Incineration			**	
Solidification			**	
Neutralization			**	
Other	**		**	
None			372	
Disposal methods				
Sewer	**	**	**	
Company site landfill				
Municipal landfill			149	
Out-of-state				
Recycle/Reuse				
By company				
By outside contract			**	
Other	**		270	
Unknown			57	

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 8

ESTIMATED VOLUMES OF TOXIC WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

Method of Handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
		Estimated volume of hazardous waste*		
Transported from plant				
By company	139	163	1,783	
By outside contract	264	250	2,038	
Treatment at plant site				
Chemical		**	**	
Incineration			232	
Solidification			**	
Neutralization	8,114	**	339	
Other	**		**	
None	1,797	411	3,102	
Disposal methods				
Sewer	9,578			
Company site landfill	**	**	**	
Municipal landfill	**	181	295	
Out-of-state	**	**	**	
Recycle/Reuse				
By company	**		**	
By outside contract	**		1,673	
Other	**	**	1,459	
Unknown	138	106	270	

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 9

ESTIMATED VOLUMES OF CORROSIVE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

Method of Handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
		Estimated volume of hazardous waste*		
Transported from plant				
By company	1,791	**	**	
By outside contract	8,140	1,192	10,171	
Treatment at plant site				
Chemical	**			
Incineration				
Solidification		**		
Neutralization	2,322	**	**	
Other	**			
None	207	**	463,818	
Disposal methods				
Sewer	57,967		**	
Company site landfill	**		**	
Municipal landfill	**	**	712	
Out-of-state	**	**		
Recycle/Reuse				
By company	**			
By outside contract	**	**	**	
Other	**		**	
Unknown	1,034	**	9,429	

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 10

ESTIMATED VOLUMES OF REACTIVE WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

	Estimated volume of hazardous waste*			
Method of Handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company		**	**	
By outside contract		**	**	
Treatment at plant site				
Chemical				
Incineration				
Solidification				
Neutralization	**	**	**	
Other				
None		**	**	
Disposal methods				
Sewer	**			
Company site landfill		**	**	
Municipal landfill		**	**	
Out-of-state				
Recycle/Reuse				
By company				
By outside contract				
Other			**	
Unknown				

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 11

ESTIMATED VOLUMES OF UNCLASSIFIED WASTE CLASSIFIED BY FORM AND METHODS OF TRANSPORTATION, TREATMENT, AND DISPOSAL

	Estimated volume of hazardous waste*			
Method of Handling	Liquid (liters)	Sludge (liters)	Solid (kilograms)	Gas (liters)
Transported from plant				
By company	**	**	6,540	
By outside contract	122	**	22,635	
Treatment at plant site				
Chemical	**			
Incineration				
Solidification			**	
Neutralization			**	
Other	**		[illegible],717	
None	1,951	**	23,326	
Disposal methods				
Sewer	**			
Company site landfill		**	2,909	
Municipal landfill	**	**	2,460	
Out-of-state			**	
Recycle/Reuse				
By company	**		**	
By outside contract	**		**	
Other	106		**	
Unknown	**	**	[illegible]	

* Estimates given in 1,000s of units.
** Five firms or fewer reporting.

TABLE 12

ESTIMATED NUMBER OF FIRMS GENERATING FLAMMABLE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	52	**	**	**	**	**	66	**
More than 500 lit./1,000 kg.	11	**	**	**	**	**	12	**
None	43	**	**	**	**	**	53	**
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	51	**	**	**	80	**	83
More than 500 lit./1,000 kg.	**	11	**	**	**	16	**	26
None	**	56	**	**	**	100	**	60

** Five sample firms or fewer reporting.

TABLE 13

ESTIMATED NUMBER OF FIRMS GENERATING PATHOLOGICAL WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**		**
More than 500 lit./1,000 kg.	**	**	**	**	**	**		**
None	**	**	**	**	**	**		**
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**		**
More than 500 lit./1,000 kg.	**	**	**	**	**	**		**
None	**	**	**	**	**	**		**

** Five sample firms or fewer reporting.

TABLE 14

ESTIMATED NUMBER OF FIRMS GENERATING TOXIC WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	**	[illegible]	**	**	**		**	101
More than 500 lit./1,000 kg.	**		**	**	**		**	
None	**	92	**	**	**		**	122
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**	**	17
More than 500 lit./1,000 kg.	**	**	**	**	**	**	**	42
None	**	**	**	**	**	*	**	14

** Five sample firms or fewer reporting.

TABLE 15

ESTIMATED NUMBER OF FIRMS GENERATING CORROSIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
Number of Firms	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**	**	**
More than 500 lit./1,000 kg.	**	**	**	**	**	**	**	**
None	**	**	**	**	**	**	**	**
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**	**	**
More than 500 lit./1,000 kg.	**	**	**	**	**	**	**	**
None	**	**	**	**	**	**	**	**

** Five sample firms or fewer reporting.

TABLE 16

ESTIMATED NUMBER OF FIRMS GENERATING REACTIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
Number of Firms	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	**	**	**		**		**	**
More than 500 lit./1,000 kg.	**	**	**		**		**	**
None	**	**	**		**		**	**
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	**	**		**		**	**
More than 500 lit./1,000 kg.	**	**	**		**		**	**
None	**	**	**		**		**	**

** Five sample firms or fewer reporting.

TABLE 17

ESTIMATED NUMBER OF FIRMS GENERATING UNCLASSIFIED WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY PLACE OF STORAGE AT PLANT SITE AND AMOUNT OF WASTE STORED OVER 24 HOURS

	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
Number of Firms	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**	**	**
More than 500 lit./1,000 kg.	**	**	**	**	**	**	**	**
None	**	**	**	**	**	**	**	**
STORAGE: (Outdoors)								
500 lit./1,000 kg. or less	**	**	**	**	**	**	**	**
More than 500 lit./1,000 kg.	**	**	**	**	**	**	**	**
None	**	**	**	**	**	**	**	**

** Five sample firms or fewer reporting.

TABLE 18

ESTIMATED NUMBER OF FIRMS GENERATING FLAMMABLE WASTE
BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE) L	QUADRANT I (NE) KC	QUADRANT II (NW) L	QUADRANT II (NW) KC	QUADRANT III (SW) L	QUADRANT III (SW) KC	QUADRANT IV (SE) L	QUADRANT IV (SE) KC
STORAGE: (Indoors)								
Stores waste	53	38	51	10	45	102	78	75
Does not store waste	43	80	17	50	50	101	83	74
STORAGE: (Outdoors)								
Stores waste	13	62	17	30	32	94	47	109
Does not store waste	83	56	51	30	63	109	114	140

** Five sample firms or fewer reporting.

TABLE 19

ESTIMATED NUMBER OF FIRMS GENERATING PATHOLOGICAL WASTE
BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE) L	QUADRANT I (NE) KC	QUADRANT II (NW) L	QUADRANT II (NW) KC	QUADRANT III (SW) L	QUADRANT III (SW) KC	QUADRANT IV (SE) L	QUADRANT IV (SE) KC
STORAGE: (Indoors)								
Stores waste	**	**	**	**	**	**		**
Does not store waste	**	**	**	**	**	**		**
STORAGE: (Outdoors)								
Stores waste	**	**	**	**	**	**		**
Does not store waste	**	**	**	**	**	**		**

** Five sample firms or fewer reporting.

TABLE 20

ESTIMATED NUMBER OF FIRMS GENERATING TOXIC WASTE
BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE) L	QUADRANT I (NE) KC	QUADRANT II (NW) L	QUADRANT II (NW) KC	QUADRANT III (SW) L	QUADRANT III (SW) KC	QUADRANT IV (SE) L	QUADRANT IV (SE) KC
STORAGE: (Indoors)								
Stores waste	42	56	**	**	97		71	[illegible]
Does not store waste	75	92	**	**	50	113	79	127
STORAGE: (Outdoors)								
Stores waste	9	73	**	73	**	95	19	79
Does not store waste	108	73	**	42	54	159	131	[illegible]

** Five sample firms or fewer reporting.

TABLE 21

ESTIMATED NUMBER OF FIRMS GENERATING CORROSIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
Stores waste	**	**	**	**	**		40	**
Does not store waste	**	**	**	**	**	**	56	**
STORAGE: (Outdoors)								
Stores waste	**	**	**	**	**	**	17	**
Does not store waste	**	**	**	**	**	**	77	**

** Five sample firms or fewer reporting.

TABLE 22

ESTIMATED NUMBER OF FIRMS GENERATING REACTIVE WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
Stores waste	**	**	**		**		**	**
Does not store waste	**	**	**		**		**	**
STORAGE: (Outdoors)								
Stores waste	**	**	**		**		**	**
Does not store waste	**	**	**		**		**	**

** Five sample firms or fewer reporting.

TABLE 23

ESTIMATED NUMBER OF FIRMS GENERATING UNCLASSIFIED WASTE BY AREA SCHOOL QUADRANT CLASSIFIED BY STORAGE CAPABILITY

Number of Firms	QUADRANT I (NE)		QUADRANT II (NW)		QUADRANT III (SW)		QUADRANT IV (SE)	
	L	KG	L	KG	L	KG	L	KG
STORAGE: (Indoors)								
Stores waste	**	**	**	**	**	**	**	14
Does not store waste	**	**	**	**	**	**	**	23
STORAGE: (Outdoors)								
Stores waste	**	**	**	**	**	**	**	37
Does not store waste	**	**	**	**	**	**	**	[illegible]

** Five sample firms or fewer reporting.

TABLE 24

ESTIMATED NUMBER OF FIRMS STORING FLAMMABLE WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard	37	**	38	50
Ingredients	67	20	53	151
Emergency Procedures	**		12	**
Other			**	**
None	59	68	167	108

** Five sample firms or fewer reporting.

TABLE 25

ESTIMATED NUMBER OF FIRMS STORING TOXIC WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard	40	47	48	17
Ingredients	38	**	50	87
Emergency Procedures	**	**	**	**
Other	**		**	**
None	111	88	128	125

** Five sample firms or fewer reporting.

TABLE 26

ESTIMATED NUMBER OF FIRMS STORING PATHOLOGICAL WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard				
Ingredients			**	
Emergency Procedures				
Other			**	
None	**	**	**	**

** Five sample firms or fewer reporting.

TABLE 27

ESTIMATED NUMBER OF FIRMS STORING CORROSIVE WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard	**		**	24
Ingredients	**		**	26
Emergency Procedures	**		**	**
Other			**	**
None	9	**	**	54

** Five sample firms or fewer reporting.

TABLE 28

ESTIMATED NUMBER OF FIRMS STORING REACTIVE WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard	**			**
Ingredients	**			**
Emergency Procedures				
Other				
None	**		**	**

** Five sample firms or fewer reporting.

TABLE 29

ESTIMATED NUMBER OF FIRMS STORING UNCLASSIFIED WASTE USING DIFFERENT TYPES OF LABELING

Number of Firms	QUADRANT I (NE)	QUADRANT II (NW)	QUADRANT III (SW)	QUADRANT IV (SE)
LABELING AS TO:				
Warning of Hazard		**		**
Ingredients	**	**	**	**
Emergency Procedures				**
Other				
None	8	**	**	47

** Five sample firms or fewer reporting.

TABLE 30

MISCELLANEOUS ESTIMATES

A. Estimated amounts of waste classified by size of firm.

	Non solid waste (1,000s of liters)	Solid waste (1,000s of kilograms)
Firms with 100 or fewer employees	21,352	4,791
Firms with more than 100 employees	110,804	569,116

B. Estimated number of firms generating waste classified by place of storage of waste at plant site and amount of waste stored over 24 hours (total columns for Tables 9A and 9B).

	Non solid waste	Solid waste
Total number of firms generating waste	962	1,299
Stores waste indoors	461	492
500 liters (1,000 kg.) or less	373	466
More than 500 liters (1,000 kg.)	88	26
No indoor storage	501	807
Stores waste outdoors	160	712
500 liters (1,000 kg.) or less	28	458
More than 500 liters (1,000 kg.)	132	254
No outdoor storage	802	587

C. Estimated number of firms generating waste and storing waste classified by quadrant.

	State total	Quad 1	Quad 2	Quad 3	Quad 4
Number of firms generating waste	1,684	371	319	357	637
Number of firms storing waste	1,310	274	225	317	494

APPENDIX D

A SUMMARY OF IOWA DEPARTMENTAL RULES PERTAINING TO HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

A SUMMARY OF IOWA DEPARTMENTAL RULES PERTAINING TO HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT*

PART I: LABELING

State Agency	Regulation
AGRICULTURE DEPARTMENT	
Chapter 1: Livestock Diseases	Trucks transporting animal carcasses must be properly labeled. 1.103(163)
Chapter 9: Pesticides	Labels on containers must show directions for use, warning of the hazard in non-technical language, and ingredients. 9.6;9.8(206)
BUREAU OF LABOR Occupational Safety and Health Division	
Chapter 10: General (The U. S. Department of Labor, Occupational Safety and Health Standards, 29C.F.R. 1910)	
Subpart H: Hazardous Materials	Labeling is in accordance with the standards of: American Conference of Governmental Industrial Hygienists; American National Standards Institute; National Fire Protection Association. 1910.100
Subpart J: General Environmental Controls	The biological hazard sign must be used to label equipment, containers, rooms, materials, and experimental animals which contain, or are contaminated with viable hazardous agents. 1910.145(e)(4)
PUBLIC SAFETY DEPARTMENT	
Chapter 39: Liquid Petroleum Gas Chapter 40: Flammable and Combustible Liquids	The rules governing these materials are standards of the National Fire Protection Association. 39.1(101); 40.1(101)
ENVIRONMENTAL QUALITY DEPARTMENT	
Chapter 26: General Conditions, Prohibitions, and Requirements	"Local regulations should include...provision for the adequate labeling of toxic and hazardous wastes." 26.5(1)[1]

---

* Wayne A. Faupel, Phyllis Barry, eds., Iowa Departmental Rules 197[illegible].

[1] Agency official said agency had no authority in this area. Responsibility was with local governments.

PART II: STORAGE

State Agency	Regulation
AGRICULTURE DEPARTMENT	
Chapter 9A: Fertilizers	Anhydrous ammonia must be stored outside buildings; distant from densely populated areas, drinking water sources, schools, hospitals. 9A.2(200)
Chapter 15: Hotels, Restaurants, Eating Establishments	Garbage must be stored in tight-lidded metal containers. 15.5(1)
BUREAU OF LABOR **Occupational Safety and Health Division**	
Chapter 10: OSHA Standards, 29 C.F.R. 1910 Subpart H: Hazardous Materials	Storage is regulated by the Compressed Gas Association Pamphlets; and by ACGIH, ANSI, NFPA. 1910.100 [2]
Chapter 26: OSHA Standards, 29 C.F.R. 1926 Subpart H: Materials Handling, Storage, Use, and Disposal	Noncompatible materials must be segregated. 1926.250b(3) [2]
COMMERCE COMMISSION	
Chapter 19: Gas Utilit	Storage of LP Gas at utility gas plants is regulated by the NFPA Standard No. 59, June, 1962.
PUBLIC SAFETY DEPARTMENT	
Chapter 40: Flammable & Combustible Liquids Code	Storage plans must be approved by the state fire marshal. 40.0(101) NFPA Standard No. 30, 1972 (with some exceptions) and its reference to other specific standards in National Fire Code, 1972-73 ed. of NFPA, regulate flammable and combustible liquids. 40.1(101)
Chapter 56: Explosive Materials	Inspection of storage facilities must be made every six months. 56.2(101A) Inventory must be taken daily, and shortages reported to the state fire marshal. 56.3(101A)
ENVIRONMENTAL QUALITY DEPARTMENT	
Chapter 26: General Conditions	Local regulations should specify types of storage containers. [3]

---

[2] Agency official referenced additional portions of the code.

[3] Agency official stated regulations pertain to packaging rather than storage and pertains to disposal at permitted landfills.

PART III: TREATMENT

State Agency	Regulation
AGRICULTURE DEPARTMENT	
Chapter 1: Livestock Diseases	Sewage and liquid waste must be rendered nonpathogenic in septic tanks. 1.101(6)[4]
Chapter 17: Meat and Poultry Inspection	Inedible meat (at pet animal food processing plant) must be decharacterized by charcoal and frozen at 40°. 17.5(3);(5)
HEALTH DEPARTMENT	
Chapter 1: Communicable Diseases	Waste must be disinfected or wrapped for autoclaving. 1.6(3) Wastes should be decontaminated by use of creosol solutions before disposal. 1.8(1)
Chapter 12: Sewage, Industrial Waste and Excreta Disposal	Treatment plant plans must be approved by the Department. 12.2(135)

---

[4] Department of Environmental Quality representative stated agency can require pretreatment prior to disposal in sewers.

PART IV: COLLECTION/TRANSPORTATION

State Agency	Regulation
AGRICULTURE DEPARTMENT	
Chapter 1: Livestock Diseases	Carcasses may be moved only by licensed disposal plant trucks. 1.103(163)
Chapter 9A: Fertilizers	Anhydrous ammonia may be unloaded only at permanently installed loading points. 9A.6(200)
Chapter 15: Hotels, Restaurants, Eating Establishments	Garbage must be moved from premises "regularly." 15.5(2)
BUREAU OF LABOR Occupational Safety and Health Division	
Chapter 10: General (OSHA Standards, 29 C.F.R. 1910) Subpart H: Hazardous Materials	Transportation of explosives. Transportation of packaged blasting agents.[5]
HEALTH DEPARTMENT	
Chapter 16: Garbage and Refuse	Collection must be frequent enough to prevent nuisance. 16.3(1)
ENVIRONMENTAL QUALITY DEPARTMENT	
Chapter 26: General Conditions	Vehicles for transporting hazardous wastes must be safely constructed.[6] 26.5(2)d

---

[5] Agency official referenced additional sections of code.

[6] Agency official stated that this regulation primarily meant enforcing and bringing to forefront existing DOT regulations.

PART V: DISPOSAL

State Agency	Regulation
AGRICULTURE DEPARTMENT	
Chapter 1: Livestock Diseases	Litter from farmyards must be burned or spread as fertilizer. 1.15(163) Animal carcasses must be burned or sent to licensed rendering plant. 1.77(3) Disposal plant plans must be approved by the Department. 1.100(163) Liquid wastes may not be discharged into a stream or poured onto the ground. 1.101(5) Sewage must be disposed of through: 1) evaporation, 2) boiling, or 3) circulation in septic tanks. 1.101(6)
Chapter 17: Meat and Poultry Inspection	Waste must be drained into a covered cesspool, city sewer, or evaporated. 17.7(8)
BUREAU OF LABOR **Occupational Safety and Health Division**	
Chapter 10: OSHA Standards, 29 C.F.R. 1910	
Subpart G: Occupational Health and Environmental Control	Asbestos waste must be enclosed in sealed, impermeable bars. 1910.93a
Subpart H: Hazardous Materials	Flammable/combustible wastes shall not be dumped into sewers, but stored in tight drums outside buildings until removed from premises. 1910.106
Chapter 26: OSHA Standards, 29 C.F.R. 1926	
Subpart H: Materials Handling, Storage, Use and Disposal	(Waste must be moved from work areas as the work progresses. 1926.252(c)) Disposal by burning shall comply with local fire regulations. 1926.252(d) Solvent waste, oily rags, flammable liquids must be kept in fire resistant covered containers until removed. 1926.252(e)
HEALTH DEPARTMENT	
Chapter 12: Sewage, Industrial Waste, and Excreta Disposal	Waste must be discharged into sanitary sewers. 12.1(135) Sewage may not be used for irrigation without a permit. 12.3(135)
ENVIRONMENTAL QUALITY DEPARTMENT	
Chapter 26: General Conditions	Hazardous waste may be disposed of only under instructions by the Public Health Commissioner. 26;27.7(4) [7]
Chapter 27: Sanitary Landfill	HW shall be isolated at the landfill site.
Chapter 28: Incineration	Permit required for incineration. 28.2(455B) [8]

---

[7] Agency official stated that rather than isolation of hazardous waste, it meant that disposal techniques must be approved by Division of Solid Waste.

[8] Two permits are required from Air Quality, one for incineration and one for disposal.

REFERENCES

REPORTS ON FEDERAL LEGISLATION

1. Battelle Memorial Institute. Program for the management of hazardous wastes. Environmental Protection Agency, 68-01-0762 (Richland, Washington) July, 1973. 2 v.

2. Booz-Allen Applied Research, Inc. A study of hazardous materials, hazardous effects and disposal methods. (Bethesda, Maryland) June 30, 1972. 3 v.

3. Office of Solid Waste Management Programs. Report to Congress; disposal of hazardous wastes. Environmental Protection Publication SW-115. Washington, U. S. Government Printing Office, 1974. 110 p.

4. Office of Solid Waste Management Programs. Report to Congress; disposal of hazardous wastes. Environmental Protection Publication SW-115. Washington, U. S. Government Printing Office, 1974. 110 p.

5. Pesticides and containers; acceptance, disposal, and storage; proposed rulemaking and issuance of procedures. Federal Register, 38 (99): 13622-13626, May 23, 1973.

6. TRW Systems Group. Recommended methods of reduction, neutralization, recovery, or disposal of hazardous waste. v.1. Summary Report. U. S. Environmental Protection Agency. 204 p. (Distributed by National Technical Information Service, Springfield, Va. as PB 224580.)

7. U. S. Congress. Atomic Energy Act of 1954. Public Law 703, 83rd Congress, H.R. 9757. Washington, D. C., August 30, 1954. 41 p.

8. U. S. Congress. Clean Air Amendments of 1970. Public Law 91-604, H.R. 17255, 91st Congress, Dec. 31, 1970. Washington, U. S. Government Printing Office. 32 p. [U. S. Code, Title 42, sec. 1857 et seq.]

9. U. S. Congress. Federal Insecticide, Fungicide, and Rodenticide Act as amended (1972). Sec. 19. Disposal and transportation. Public Law 92-516, 92nd Congress, H.R. 10729. Washington, D. C., October 21, 1972. p. 23-24.

10. U. S. Congress. Marine Protection, Research, and Sanctuaries Act, as amended. Title I--Ocean dumping. Sec. 101. Public Law 92-532, 92nd Congress, H.R. 9727. Washington, D. C. October 23, 1972. 12 p. [U. S. Code, Title 33, sec. 1401 et seq.]

11. U. S. Congress. Federal Water Pollution Control Act as amended. Public Law 92-500, 92nd Congress, S. 2770. Washington, D. C., October 18, 1972. 89 p.
    [U. S. Code, Title 33, sec. 1251 et sec.]

REFERENCES

PUBLISHED STATE HAZARDOUS WASTE SURVEY REPORTS

12. Abbott, Barry, and Wesley A. Shonerd. Industrial solid waste survey. Arizona Department of Health, June, 1974. 30 p.

13. Barr Engineering Company. Hazardous waste generation Twin Cities metropolitan area. Minneapolis, Metropolitan Inter-County Council, Minnesota Pollution Control Agency, October, 1973. 1 v. (various pagings).

14. [Draft summary of industrial waste generation in Nebraska.] Goldwater, Leonard J., Stephen D. Bundy et al. Proposed Illinois regulated chemicals list unedited. Illinois Institute for Environmental Quality, July, 1975. 498 p.

15. Guidelines for hazardous waste land disposal facilities. California State Department of Public Health, January, 1973. 44 p.

16. Hazardous waste disposal survey--1971. Sacramento, California State Department of Public Health, Jan. 1972. 69 p.

17. Hazardous waste disposal survey, 1971. California State Department of Public Health, January, 1972. 69 p.

18. Hazardous waste management planning, 1972-73. State of Oregon, Department of Environmental Quality, March 1974. 43 p.

19. Hayes, A. J. OSWMP files on Louisiana hexachlorobenzene episode. Unpublished data.

20. Idaho solid waste management industrial survey report. Idaho Department of Environmental and Community Services, June, 1973. 71 p.

21. A plan for solid waste management in Pennsylvania. Pennsylvania State Department of Health, June 1970. 162 p.

22. A report on industrial and hazardous wastes. State of Arizona, Department of Health, June, 1975. 110 p.

23. A report on industrial and hazardous wastes. State of Washington, Department of Ecology, December, 1974. 90 p.

24. Resource Management Associates, Inc. Report on preliminary survey of firms generating hazardous waste. Maryland State Health Department, June, 1975. (various pagings).

25. Special waste survey report. Mississippi State Board of Health, September 1975. (various pagings).

26. Status of hazardous waste generation and disposal in the Wichita, Kansas area. Kansas Department of Health and Environment, September, 1975. 13 p.

REFERENCES

27. Storm, David L., and Earl Margitan. Survey of operational procedures at Class I hazardous waste disposal sites in California. *California Vector Views*. 22 (2): 9-18, February, 1975.

28. A study of liquid and semi-solid waste collection and disposal problems in the metropolitan Atlanta area and planned remedial program. State of Georgia, Environmental Protection Division, October, 1975. 4 p.

29. Survey of liquid waste management in Illinois. Illinois Institute for Environmental Quality, September, 1975. (various pagings).

30. W. Owen Thompson, Directory of special waste processing and disposal sites in northeastern Illinois. Illinois Institute for Environmental Quality, September, 1975. 24 p.

31. Waste discharge requirements for waste disposal to land; disposal site design and operation information. California State Water Resources Control Board, November, 1972, reprinted October, 1974. 63 p.

32. Roy F. Weston, Inc. Solid Waste Management in Illinois. *Volume 2: Special wastes*. Illinois Institute for Environmental Quality, n.d. (various pagings).

REPORTS ON SOLID WASTE MANAGEMENT

33. Anderson, Thomas, Donald R. Andres, *et al*. The States' roles in solid waste management; a task force report. Lexington, The Council of State Governments, 1973. 58 p. Reprinted [Cincinnati], U. S. Environmental Protection Agency, July 1973.

34. Basic issues on solid waste management affecting county government. National Association of Counties. [Washington] U. S. Environmental Protection Agency, May, 1973. 40 p.

35. Brunner, D.R., J. Hubbard, D.J. Keller and J.F. Newton. Closing open dumps. Environmental Protection Publication SW-61ts. Washington, U. S. (GPO), 1972. p. 19.

36. Dennis, W.H. Methods of chemical degradation of pesticides and herbicides - a review. Edgewood Arsenal, U. S. Army Medical Environmental Engineering Research Unit, Oct. 1972. 30 p.

37. Eldredge, R.W., Minimizing Leachate at Landfills. *American Public Works Association Reporter*, vol. (no.): 22-23, Jan. 1974.

38. Environmental information; hazardous wastes and their management. Washington, U. S. Environmental Protection Agency, May 1975. 3 p.

REFERENCES

39. Fields, T., and A. W. Lindsey, Hazardous Waste Technology assessment summary--hazardous waste treatment/disposal at Chem-Trol Pollution Services, Inc. Washington, U. S. Environmental Protection Agency, Apr. 3, 1974.

40. Fields, T., and A. W. Lindsey, Hazardous Waste Technology assessment summary--chemical fixation of industrial wastes at Chemfix, Division of Environmental Sciences. Office of Solid Waste Management Programs, U. S. Environmental Protection Agency, Washington, D. C., Apr. 3, 1974.

41. Funkhouser, J. F., Alternatives to the management of hazardous wastes at national disposal sites. Washington, U. S. Environmental Protection Agency, May 1973. 85 p.

42. Goulding, R. L. Waste pesticide management. Washington, U. S. Environmental Protection Agency, Aug. 1973. 81 p.

43. Hayes, A., Hazardous waste disposal operations. Washington, U. S. Environmental Protection Agency, May 15, 1974.

44. Hazardous Waste Control Act, Assembly Bill 598; draft criteria and standards. Sacramento, California State Department of Public Health, Feb. 11, 1974.

45. Industrial waste management; seven conference papers. Environmental Protection Publication SW-156. [Washington], U. S. Environmental Protection Agency, Feb. 1975. 111 p.

46. Landfill disposal of hazardous wastes: a review of literature and known approaches. EPA/530/SW-165. September 1975.

47. Ocean dumping, final regulations and criteria. Federal Register 38(198): 28618, October 15, 1971.

48. Our effluent society; the States and solid waste management. The Council of State Governments. [Washington], U. S. Environmental Protection Agency, 1974. 41 p.

49. Personal communication. J. P. Lehman, Office of Solid Waste Management Programs, to F. Green, Office of International Affairs, Oct. 10, 1973.

50. Personal communications. J. P. Lehman, Office of Solid Waste Management Programs, to the record. Sept. 12, 1973, and Jan. 23, 1974.

51. Personal communication. W. Lindenmaier, Lindenmaier - Precision Company, West Germany, to J. P. Lehman, Office of Solid Waste Management Programs, Oct. 25, 1973.

REFERENCES

52. Personal communications. C. C. Wiles, Solid and Hazardous Waste Research Laboratory, to A. W. Lindsey, and T. Fields, Office of Solid Waste Management Programs. Procurement requests for deep well and salt mine disposal work, Feb. 6 and 27, 1974.

53. Program for the management of hazardous wastes for Environmental Protection Agency, Office of Solid Waste Management Programs; final report. Richland, Wash., Battelle Memorial Institute, July 1973. 385 p.

54. Pond pit reservoir liners of DuPont Hypalon (synthetic rubber). Wilmington, Del., E. I. DePont de Nemours and Co., Inc., Elastomer Chemicals Department.

55. Rhyne, C. W. Landfill gas. Washington, U. S. Environmental Protection Agency, Apr. 4, 1974. 20 p.

56. Saint, P. K., C. P. Straub and H. O. Pfannkuch. Effect of landfill disposal of chemical wastes on groundwater quality. Presented at Hydrogeology Section of Annual Meeting, Geological Society of America, Minneapolis, Nov. 14, 1972.

57. Scurlock, A. C., A. W. Lindsey, T. Fields, Jr., D. R. Huber. Incineration in Hazardous Waste Management. Washington, U. S. Environmental Protection Agency, Feb. 1975. 104 p.

58. Slover, Edwin E. solid waste disposal in a multi-product chemicals plant, Institute Plant - Union Carbide Corp., Institute, West Virginia. Presented at Symposium on the Textile Industry and the Environment - 1973, Washington, May 22-24, 1973. 22 p.

59. Solid waste management; abstracts and excerpts from the literature--1964. J. A. Connolly and S. E. Stainback. Public Health Service Publication No. 91--1964, Suppl. G. Washington, U. S. Government Printing Office, 1971. 280 p.

60. Solid waste management; abstracts from the literature--1965. J. A. Connolly and S. E. Stainback, Public Health Service Publication No. 91--1965, Suppl. H, Washington, U. S. Government Printing Office, 1972. 216 p.

61. Solid waste management; abstracts from the literature--1966. Franklin Institute Research Laboratories Public Health Service Publication No. 91--1966, Suppl. I, Washington, U. S. Government Printing Office, 1972. 147 p.

62. Solid waste management; abstracts and excerpts from the literature, v. 1-2. C. G. Goleuke, Public Health Service Publication No. 2038, Washington, U. S. Government Printing Office, 1970. 147 p.

63. Solid wastes; proposed guidelines for storage and collection. U. S. Environmental Protection Agency. Federal Register 40 (134): 29404-29408, July 11, 1975.

REFERENCES

64. State activities in solid waste management, 1974. R. J. Black. Environmental Protection Publication SW-158. [Washington], U. S. Environmental Protection Agency, June 1975, 216 p.

65. State program implementation guide: hazardous waste surveys. C. H. Porter. Environmental Protection Publication SW-160. [Washington], U. S. Environmental Protection Agency, 1975. 38 p.

66. Symposium of State and interstate solid waste planning agencies, Sept. 9-11, 1969, St. Louis, Missouri. L. A. Gluckman, ed. Public Health Service Publication No. 2093. Washington, U. S. Government Printing Office, 1971. 92 p.

67. Thermal processing and land disposal of solid waste; guidelines, Federal Register, 39 (158): 29327-29338, August 14, 1974.

68. Toftner, Richard O. Developing a state solid waste management plan. U. S. Department of Health, Education and Welfare, 1970.

69. U. S. Environmental Protection Agency - Administrators' decision statement No. 5 on EPA policy on subsurface emplacement of fluids by well injection.